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CONTENTS.

EDITORIAL:
- Lamp Renewals ... 917
- Electricity and the Children ... 918
- Lighting Copley Square ... 918
- Must the Trunk Lines Be Rebuilt? ... 918

Reducing the Time Constant in Magnetic Tests ... 920
National Electric Light Association ... 921
Annual Meeting of the American Institute of Electrical Engineers ... 921
Electrical Engineering at Armour Institute ... 922
Canadian Electrical Association ... 922
Nebraska Electrical Association ... 923
Colorado Adopts Strict Measures Against Theft of Electricity or Gas ... 926
Nebraska Telephones and Trolleys ... 926
Indiana Independent Telephone Association ... 927
Smokeless Combustion of Coal in Boiler Plants ... 928
New 300-Horsepower High-Pressure Fire-Service Pumping-Station for Philadelphia ... 929
Mammoth Demonstrations of Electric Household Appliances at Denver 930
Boston's Lights Tested ... 930
Alternating Currents and Their Applications ... 931
Light by Wireless ... 933
Factors Determining the Efficiency of Trolley Wires ... 934
QUESTIONS AND ANSWERS ... 937
Government Examination for Wireless Experts ... 938
Tariff on Electric Light Carbons ... 939
Chicago Electric Club ... 939
FINANCIAL REPORTS OF ELECTRICAL COMPANIES ... 940
Electric Illumination at the Alaska-Yukon-Pacific Exposition ... 942
New York Section, Illuminating Engineering Society ... 943
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE ... 944
INDUSTRIAL SECTION:
- Small Single-Phase Motors ... 946
- An Improved Ventilating Fan ... 946
- Motor-Driven Vertical Boring Mill ... 947
- Electrically-Driven Coffee Grinders ... 947
- New Electric Toaster-Stove ... 947
- Chicago Yards of the Naugle Pole and Tie Company ... 948
- New Electric Annunciator ... 948
- De Forest Wireless Telephone and Telegraph Apparatus ... 949

CURRENT ELECTRICAL NEWS ... 951
RECORD OF ELECTRICAL PATENTS ... 957

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LAMP RENEWALS.

Although it is estimated that some 6,000,000 tungsten lamps were sold in this country during the past year, it has not received what might be termed a "joyous welcome" from all central-station managers. Just what proportion of the tungsten lamps in use were connected up by company men or at least under their supervision it would be hard to determine, but unless it was one hundred, the percentage would be too low.

The most important of all the assets which comprise a wholesome public opinion of the product, is the one of proper lighting devices, properly installed and properly maintained.

This asset is one which central stations have always been proud of, and with reason. It is vital to the industry and any "doubting Thomas" can read the future if he will but trouble to read the past, taking gas lighting as the example.

Gas companies have supplied burners, of the open-flame type, to customers without charge, since the inception of the art. Electric companies followed suit with carbon-filament incandescent lamps.

Along in the nineties the gas man's high-efficiency lamps, perfected by Dr. Auer von Welsbach, came into prominence and became justly popular. They were sold indiscriminately to whoever would buy, with the natural result that in thousands of cases consumers felt that they had not really received all they were promised.

While it is true that the mantle gave the gas industry a new lease of life, it lost them many friends who could not obtain the service they demanded.

Following close upon the introduction of gas mantles, came the gas range, and this proved such a wonderful revenue producer that the troubles of gas-lighting consumers were lost sight of. These appliances were also sold indiscriminately, but the day of reckoning must come, and in many cases has already arrived.

Burners and ranges no longer sell themselves, and in seeking new business the truth is beginning to be felt that neither will these appliances maintain themselves, so that the custom of maintaining appliances is now largely carried on.

Now, although the new electric lamps may not have inherent defects as great nor as numerous as the gas appliances in question, poor lots of lamps are sure to appear, and as surely will cause trouble, not for the lamp makers, but for the central station. Even though renewals are not free of charge the lamps should always be under the control of the central station.

ELECTRICITY AND THE CHILDREN.

It is said that in the United States the children are the real rulers of the country. Certain it is that anything that actively hurts the girl or boy, once it is generally known, will meet with prompt suppression; but is the condition of the vast army of children improved as it might be?

Mrs. Browning's immortal verses, "Hear the Cry of the Children," written sixty years ago, did much to start the crusade on their behalf, and today restrictions as to age of employment, compulsory education, sanitary laws, and public opinion do much toward the uplifting of their lot.

But there is still much to be done, and it is certain that electricity will have its share in most of the future work. As it is today, many people who should know better, and to whom it is an accessible convenience, neglect to use electricity in their dwelling places, be it house or flat. Now, it is certain that the air of a nursery cannot be too pure, and members of the National Electric Light Association who put forward all manner of arguments on behalf of the use of electric light should never miss this point. They must insist always that physicians advise gas should never be used at all in the children's rooms or in schools if it is possible to do without it.

It is pure air in early life that makes the future constitution.

Gas in burning gives off quantities of carbonic acid and sulphuretted hydrogen which vitiate the air. An even better light is oil. Less objectionable still is the light of candles. Two candles produce nearly as much carbonic acid as a full grown man. The flame of a lamp or gas burner will poison the air with carbonic acid to the same extent as two adults.

As to gas, it is a baneful product charged with all sorts of lung complaints, poisoning all members both of the animal and vegetable kingdoms within doors. The condition of ferns where gas is used is usually noted very quickly, but how about the children? Physicians say gas should never be used or kept burning in night rooms. The most healthy light that can be burned is, of course, electric light, and members of the National Electric Light Association should first, last and all the time use this great sanitary argument in order that electric installation should be made wherever possible.

LIGHTING COPLEY SQUARE.

Copley Square is much the finest public place architecturally in Boston, and one of the finest in the United States.

Across one entire side runs the Public Library and along the opposite side, about 400 feet distant, is Trinity Church. The Museum of Fine Arts bounds one of the remaining sides and parallel with this and about 320 feet away is Boylston Street, with a row of fine buildings, including the Old South Church, on the other.

Until very recently this square has been lighted with seven direct-current enclosed arc lamps by the Boston Edison Company, but under the new street-lighting contract the work is done with three flaming arc lamps of the General Electric make.

It is of interest to note that this change in the type of lamp and, as will appear presently, in the method of erection, brings the lighting of Copley Square into line with that of Brandenburger Square in Berlin, where, as noted in our editorial of April 17, flaming arcs are in use.

The seven direct-current enclosed arc lamps that have been displaced were distributed around Copley Square at an elevation of nineteen feet above the ground, and at their normal rating of 500 watts each the power expended in lighting the space was 3,500 watts.

In the application of flaming arcs to this public space the number of lamps and the total power consumed has been reduced more than one-half, the lamps have been moved toward the center of the square, and the height of each has been multiplied by nearly three.

Each of the flaming arc lamps operates with 6.7 amperes direct-current and seventy-five to eighty volts, representing perhaps 520 watts on an average, or a little more power than one of the displaced lamps. The three flaming arcs are located in the square, so that the lines joining them form a triangle, with one side about 250 feet and each of the other two sides about 200 feet long, as nearly as was determined by pacing, and each lamp has the center of its globe fifty-two feet above the ground.

In the Brandenburger Square at Berlin, the flaming arcs are reported to have an elevation of fifty-nine feet.

As might be expected with the elevation of fifty-two feet, equal to one-fourth to one-fifth of the distances between lamps, a fine distribution of light is obtained in Copley Square, and this was demonstrated to the public a few nights since by lighting alternately the seven enclosed arcs and the three flaming arcs, at an hour previously announced by advertisement in the newspapers.

A large part of the saving effected by the substitution of the flaming arc lamps for the enclosed arcs at Copley Square has gone to the public in the form of lower rates, for the yearly price of each flaming arc is $156, or $468 for the three, while the former price of the enclosed arcs was $118 each, or $828 for the seven. Under the new contract the yearly rate for the enclosed arcs that remain in use is $92.39 each.

Owing to the high efficiency of the flaming arcs and the good distribution obtained by their elevation fifty-two feet above the ground, it would perhaps be impossible to find another public space in the United States today where as high a minimum illumination is obtained with an equal number of watts per square foot of area as that at Copley Square.

At Park Square, a pair of the flaming arc lamps have been erected on a cross bracket at a single pole, but in this case the centers of the lamp globes are only forty-three feet above the pavement.

MUST THE TRUNK LINES BE REBUILT?

A prominent railroad president has told the public that the trunk lines must soon be rebuilt to carry the increasing traffic, and many facts appear to support this conclusion, if the steam locomotive is to continue to furnish the motive power.

It is well known that in the effort for economy in transportation the limit in the length of freight trains has been substantially reached, unless the tractive power of the locomotive can be increased. The tractive power is simply a function of the weight on the locomotive drivers, and is usually taken at twenty per cent of this weight, so that an increase of tractive power means an increase of weight.

As there are important reasons why the weight of steam locomotives should not be greatly increased without extensive reconstruction of railways, the demand for greater tractive power is really behind the suggestion for reconstruction.

With the present standard gauge of railways, every increase of weight and tractive power in the steam locomotive means usually an increase in its length, and this lengthening process has already been carried about as far as is desirable with the existing curves on the roads. Wider tracks would, of course, permit greater weight in locomotives per foot of length.

Another and even more serious objection to any large increase in the weight of steam locomotives without railway reconstruction is the lack of strength and capacity in tracks and bridges to safely and economically sustain this increase. How important this lack of track and bridge capacity really is may be gathered from some facts in the history of American railways.

One of the most striking facts in this history is the great and constant increase in the weight of locomotives, from the early days of railroads to the present time. The weight of the Grasshopper engines on the Baltimore & Ohio, in 1835, was 10.7 tons, in 1851 Winans' Camel on eight wheels weighed 37.3 tons, the Consolidation engines of 1873 had a weight of 52.6 tons, and the Consolidation engines of 1894 reached 80.4 tons. Engines on the New York Central and other railroads showed a similar rate of increase, and at the present time steam locomotives have passed the 100-ton mark.

With this multiplication of locomotive weights by ten in seventy-four years, and the doubling of these weights since 1873, the strength of tracks and bridges on the railroads has not kept pace. Rails still rest directly on the wooden ties, though their sections and weights have largely increased, and many bridges that were built in the seventies and eighties are still in use today.

Examples of these early bridges still in use are the Steel Arch Bridge across the Mississippi River at St. Louis, and the Cantilever Bridge of the Michigan Central Railroad at Niagara Falls.

Many of these early railroad bridges have been strengthened from time to time to keep them safe with the increasing weight of steam locomotives, but there is, of course, a limit beyond which this process of strengthening an old structure becomes impracticable. So it is that many railroad bridges, which will have many years of useful future life if used by the existing locomotives, must be replaced as soon as much heavier locomotives come into use.

Such a reconstruction of the trunk lines as is demanded by the prospective increase of weight in steam locomotives will include wider cuts and fills, curves of longer radii, longer ties for wider gauge tracks, heavier rails and probably chairs to distribute the rail pressure over more surface, and wider and stronger bridges to carry the heavier locomotives.

The expense of all this reconstruction must run into hundreds of millions of dollars, and it is thus an important question whether a large part of this expense cannot be saved by the substitution of electric for steam locomotives?

Electric locomotives, like those that develop steam power, must, of course, depend on the weight concentrated on the driving wheels for their tractive effort, but the entire weight of the electric locomotive may be on the drivers. Thus on the Valtellina line the weight of electric locomotives is 140,000 pounds and they develop a tractive power of 28,000 pounds, or twenty per cent of this weight.

With steam locomotives, on the other hand, the freight type usually has eighty to ninety per cent, and the passenger type only fifty to seventy-five per cent of its weight on the driving wheels. It follows that electric locomotives of the same weights as those now operating with steam will exert ten to 100 per cent more tractive power.

Such increase of tractive power can readily be provided for in the electric parts of locomotives without exceeding the present widths of the steam type and in even less length. In fact, the power capacity of electric locomotives on tracks of the present gauge may readily be carried much beyond what is possible with steam, and the recent design of electric locomotives of 5,600 horsepower capacity each for use in the tunnel of the Pennsylvania Railroad terminal at New York is an illustration on this line.

Another great advantage of electric locomotives, where an increase of tractive power on present tracks and bridges is required, lies in the practicability of connecting two or more of these locomotives to act as a unit under a single control, which cannot be done with steam machines. By such connection of electric locomotives several times the weight and tractive power that can safely be concentrated in a single steam locomotive on many of the present bridges can be obtained. As two electric locomotives coupled in tandem would have a combined length equal to, say, twice that of a steam locomotive, the weight per foot on bridges need not be increased by such coupling.

It appears from the above that at least twice the tractive power of the steam locomotive may be obtained by the use of electricity, with no increase of the weight per foot on tracks and bridges, and in this way the length and capacity of trains may be doubled without increase of stress in existing railroad structures.

Any such increase of train capacity would appear to remove to the distant future any necessity for the general reconstruction of railroads in the way indicated above, and would certainly permit the use of present bridges for many years to come.

REDUCING THE TIME CONSTANT IN MAGNETIC TESTS.

BY F. M. HARTMANN AND ALBERT BALL.

For the purpose of determining the magnetic properties of test pieces, the "yoke and bar method" is, in a great many cases, the most convenient, the test pieces being most readily obtained in this form and the windings are made once for all, giving a permanent piece of apparatus.

One difficulty, however, is frequently experienced, *i. e.*, the time of building up and decaying of the current in the magnetizing coil may be a large fractional part of the period of the ballistic galvanometer at hand. As a matter of fact, cases have presented themselves where the time of reversal of the current, due to the inductance of the magnetizing coil, was greater than the time of swing of the galvanometer coil.

The time of building up may, of course, be reduced to any desired value by introducing the proper amount of resistance in series with the magnetizing coil.

The following method has been found perfectly satisfactory in this respect, and possesses the further advantage of permitting the applied electromotive-force to be varied at pleasure:

In the accompanying circuit diagram AB is a non-inductive resistance of such current-carrying capacity that it may be connected across a circuit E of 250 volts or more. R is a variable non-inductive resistance connected in series with the magnetizing coil of self-induction L and resistance r.

Let the sliding contact be in such a position that the resistance, AB, is broken into the parts a and b. When the switch is closed the electromotive-force, e, applied to the branch including the magnetizing coil is obviously a variable. Let i be the instantaneous value of the current in the magnetizing coil, and i_b the value of the current at the same instant in the resistance b. The simultaneous value of the current in a is $i + i_b$.

The equation for the current in b is,

$$i_b = \frac{e}{b}; \qquad (1)$$

but $$e = (\mathrm{R}+r)\, i + \mathrm{L}\frac{di}{dt}; \qquad (2)$$

hence, $$i_b = \frac{\mathrm{R}+r}{b}\, i + \frac{\mathrm{L}}{b}\frac{di}{dt}; \qquad (3)$$

Again, $$\mathrm{E} = a\,(i_b + i) + e; \qquad (4)$$

substituting in (4) for e and i_b the values as found in (2) and (3), we have:

$$\mathrm{E} = \frac{a}{b}(\mathrm{R}+r)\, i + \frac{a\mathrm{L}}{b}\frac{di}{dt} + a\, i + (\mathrm{R}+r)\, i + \mathrm{L}\frac{di}{dt}; \qquad (5)$$

rearranging, we have:

$$\mathrm{E} = \left((\mathrm{R}+r)\left(\frac{a}{b}+1\right) + a\right) i + \mathrm{L}\left(\frac{a}{b}+1\right)\frac{di}{dt}; \qquad (6)$$

Designating the first coefficient by m and the second by n, equation (6) may be written:

$$\mathrm{E} = m\imath + n\frac{di}{dt}; \qquad (7)$$

Separating the variables, we have:

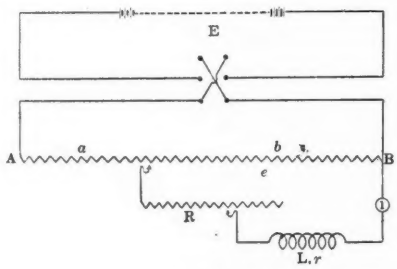
$$\frac{di}{i - \frac{\mathrm{E}}{m}} = -\frac{m}{n}\, dt. \qquad (8)$$

By integration and transposition:

$$i = \frac{\mathrm{E}}{m} + \mathrm{C}\, e^{-\frac{m}{n}t} \qquad (9)$$

From the conditions, when $t=0$, $i=0$; $\mathrm{C} = -\frac{\mathrm{E}}{m}$ is found, and equation (9) becomes:

$$i = \frac{\mathrm{E}}{m}\left(1 - e^{-\frac{m}{n}t}\right) \qquad (10)$$



CIRCUIT DIAGRAM IN MAKING MAGNETIC TESTS.

Substituting in equation (10) the values of m and n, we obtain:

$$i = \frac{\mathrm{E}}{(\mathrm{R}+r)\left(\frac{a}{b}+1\right)+a}\left(1 - e^{-\frac{(\mathrm{R}+r)+\frac{ab}{a+b}}{\mathrm{L}}t}\right) \qquad (11)$$

It can readily be shown that on breaking the circuit the equation for the current is:

$$i = \frac{\mathrm{E}}{(\mathrm{R}+r)\left(\frac{a}{b}+1\right)+a}\, e^{-\frac{\mathrm{R}+r+b}{\mathrm{L}}t} \qquad (12)$$

Equations (11) and (12) plainly show the advantage of this method in reducing the time constant, and what relations to choose between a, b and R to work to the best advantage. It is, of course, understood that L is not a constant in a circuit containing iron; but that does not invalidate the argument.

United States Statistical Abstract.

The Statistical Abstract, which originated thirty years ago, and which in its first issue was a thin pamphlet of but little over 100 pages, has been issued annually by that bureau since that date, increasing from year to year the scope of its operations, until it now includes within its more than 700 pages information regarding a great variety of subjects concerning conditions in the United States.

The latest edition has just appeared. It is replete with interesting figures and it states, among many other things, that the developed waterpower of the United States is 5,357,000 horsepower, and the number of wheels which it turns at 52,827. The estimated coal supply of the United States is put down, from statements made before the Conservation Commission, and included in this volume, at 3,135,708,000,000 tons; while the output from the mines of the United States in 1907, the year of the largest production, was 429,000,000 tons.

The wealth of the United States in 1850, according to the figures of the Census Office, was seven billions of dollars, speaking in round terms; in 1860, sixteen billions; in 1870, thirty billions; in 1880, forty-three-and-one-half billions; in 1890, sixty-five billions; in 1900, eighty-eight-and-one-half billions; and in 1904, 107 billions; the average wealth per capita being, according to the same authority, in 1850, $308; in 1860, $514; in 1870, $780; in 1880, $850; in 1890, $1,039; in 1900, $1,165; and in 1904, $1,310.

Aerial Torpedoes.

Some experiments with aerial torpedoes are being carried out by Professor Weichert of the Meteorological Institute at Gottingen. These flying torpedoes are driven by small electric motors and travel at a great speed. Control of the machine during flight by means of electric waves is one of the objects to be attained by these experiments, which the Krupp company, of Essen, Germany, is now subsidizing to the extent of $2,500 a year.

Professor Weichert is also desirous of investigating the atmosphere conditions at high altitudes by means of electrically driven and controlled flying machines which can be directed to a great height and brought back to the starting point by the operator from a point on the earth. The speed attained by the aerial torpedoes is tremendous, yet their dirigibility is as perfect as with the submarines.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

THIRTY-SECOND CONVENTION, ATLANTIC CITY, JUNE 1-4.

Arrangements are about complete for the thirty-second convention of the National Electric Light Association, which will be held at Atlantic City, N. J., June 1, 2, 3 and 4.

A special rate of a fare and three-fifths on the certificate plan for the round trip has been authorized by the various traffic associations. The Electric Light Special will leave Chicago for Atlantic City Sunday, May 30, at 3 p. m., arriving early Monday afternoon, May 31. This train will run as a second section of the eighteen-hour flyer over the Pennsylvania Railroad, and will be under the supervision of J. J. Schayer. A special train will leave New York at 9:55 a. m. Monday, May 31, and a special train is being arranged from Boston.

The arrangements for the entertaining of those in attendance at the convention have been receiving the active attention of the entertainment committee.

For Monday night arrangements have been made to have the pier given over for the exclusive use of the delegates and guests. The exhibition of Class D members will be formally opened at 8 o'clock. The reception will be held in the same hall at 9 o'clock, to be followed by dancing, at which light refreshments will be served on the balconies overlooking the ocean and the boardwalk.

For Wednesday afternoon the Inlet Baseball Park has been secured and a baseball game is scheduled between teams made up of members representing the East and the West.

On Thursday evening the large meeting room on the pier will be the scene of a unique entertainment. This feature has been designated a Café Chantant and a high-class musical and vaudeville entertainment will be produced.

The demand for exhibition space has necessitated many additional booths. The following members will exhibit:

Allis-Chalmers Company, New York city; American District Steam Company, New York city; American Electric Heater Company, Detroit, Mich.; American Electric Lamp Company, Philadelphia, Pa.; Anderson Carriage Company, Detroit, Mich.; A. & J. M. Anderson Manufacturing Company, Boston, Mass.; Baker Motor Vehicle Company, Cleveland, Ohio; C. W. Lee Company, New York city; Columbus Buggy Company, Columbus, Ohio; Commercial Truck Company, Philadelphia, Pa.; Cooper Hewitt Company, Pittsburg, Pa.; C. J. Toerring Company, Philadelphia, Pa.; Crocker-Wheeler Company, Ampere, N. J.; Dearborn Drug and Chemical Company, Chicago, Ill.; Dossert Company, New York city; Duncan Electric Manufacturing Company, Lafayette, Ind.; Duplex Metals Company, New York city; Economical Electric Lamp Company, New York city; Electrical Storage Battery Company, New York city; *Electrical World*, New York city; ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago, Ill.; Electric Suction Sweeper Company, New Berlin, Ohio; Federal Electric Company, Chicago, Ill.; Fibre Conduit Company, Orangeburg, N. Y.; Fort Wayne Electric Works, Fort Wayne, Ind.; Fraley Hand Vibrator Company, New York city; General Electric Company, Schenectady, N. Y.; General Vehicle Company, Long Island City, N. Y.; H. B. Camp Company, New York city; H. W. Johns-Manville Company, New York city; John A. Roebling's Sons Company, Trenton, N. J.; Metropolitan Engineering Company, Brooklyn, N. Y.; Mineral-lac Company, Chicago, Ill.; National Electric Lamp Association, Cleveland, Ohio; Nernst Lamp Company, Pittsburg, Pa.; Novelty Incandescent Lamp Company, Emporium, Pa.; Pettingell-Andrews Company, Boston, Mass.; Philadelphia Electric Manufacturing Company, Philadelphia, Pa.; Pittsburg Transformer Company, Pittsburg, Pa.; Pittsburg Reinforcing Pole Company, Pittsburg, Pa.; *Popular Electricity* Publishing Company, Chicago, Ill.; Sangamo Electric Company, Springfield, Ill.; Southern Exchange Company, New York city; Standard Underground Cable Company, Pittsburg, Pa.; Studebaker Automobile Company, New York city; Star Electrical Concern, New York city; Simplex Electric Heating Company, Cambridge, Mass.; Standard Electric Accumulator Company, New York city; The Rauch & Lang Carriage Company, Cleveland, Ohio; The Ricker Manufacturing Company, Rochester, N. Y.; Tungstolier Company, Cleveland, Ohio; United States Light and Heating Company, New York city; Wagner Electric Manufacturing Company, St. Louis, Mo.; Western Electric Company, New York city; Westinghouse Electric Manufacturing Company, Pittsburg, Pa.; Woods Motor Vehicle Company, Chicago, Ill.

Annual Meeting of the American Institute of Electrical Engineers.

On Tuesday evening, May 18, was held the annual meeting of the American Institute of Electrical Engineers in the auditorium of the Engineering Societies Building in New York city. The board of directors presented its report for the fiscal year. Reports from the officers and from several standing committees were also presented and accepted. The nominating committee presented its list of nominations for officers for the ensuing year, based on the previous vote of the membership of the Institute. Following this came the formal annual election of officers. By the adoption of the committee's nominations, the officers declared elected are:

President—Lewis B. Stillwell, New York city.

Vice-Presidents—John J. Carty, New York city; Paul M. Lincoln, Pittsburg, Pa.; Paul Spencer, Philadelphia, Pa.

Managers—A. W. Berresford, Milwaukee, Wis.; W. S. Murray, New Haven, Conn.; H. H. Norris, Ithaca, N. Y.; S. D. Sprong, New York city.

Treasurer—George A. Hamilton, New York city.

Secretary—Ralph W. Pope, New York city.

The technical portion of the meeting consisted of the reading of a paper on "The Patent System in Its Relation to Industrial Development," by Frederick P. Fish of the law firm of Fish, Richardson, Herrick and Neave, of Boston, and formerly president of the American Telephone and Telegraph Company.

Following the reading of the paper, the subject was discussed by Francis B. Crocker, Albert G. Davis, Arthur Von Broesen, Edgar Bull, Thomas B. Kerr, Charles P. Steinmetz, Livingston Gifford, Charles A. Terry and E. W. Rice, Jr. An abstract of this paper and of the discussion upon it will be given in these columns in the next issue.

Welds Copper and Steel.

Matthew Wilson of Dysart, Ia., says he has invented a process of welding copper and steel. He also says he has welded two pieces of copper as solidly as if they were molded.

He exhibits in his shop at Dysart a hammer, the handle of which is of copper and the face of steel. He can be seen pounding an anvil any day with this hammer. He says his process of welding is the first in the history of the world to prove successful.

Electrical Engineering at Armour Institute of Technology.

At the close of its present collegiate year, which is its sixteenth and has been one of its most successful, Armour Institute of Technology has made a number of changes that will materially advance the standard of its educational work. Among these is the decision to drop the preparatory courses within the next year and to devote the entire energies of the institution to the highest grade of engineering work. This is in line with a general policy adopted some years ago, as the result of which a number of other subsidiary educational efforts have been eliminated for the betterment of the strictly technical courses.

Another change of particular interest that has just been carried out is the reorganization of the department of electrical engineering which will enable it to give a still more thorough and better coordinated course and one which will be in closer harmony with the latest and best practice in this engineering line. While the teaching of the fundamental principles forms the groundwork of the course, there has been incorporated with it enough of the practical applications of these principles to actual problems in both general and specialized lines to give the student a good grasp of the commercial as well as the purely technical aspects of his future engineering work. The location of the Institute in Chicago is particularly favorable in this connection.

To show how the student advances in his electrical studies it will suffice to note the time devoted to these studies. In the freshman year, as in most of the higher technical schools, no specialized engineering work is taken up, but the entire time is given to the advanced scientific and mathematical work upon which all engineering is based, as well as to drafting, shop-work and several cultural studies. In the sophomore year, besides these auxiliary studies six hours per week is devoted to the theory and practice of electrical measurements in the lecture room and laboratory. During the junior year this is continued and the theory and design of direct-current dynamos is taken up, the total class room and laboratory work of the electrical studies taking eleven hours per week. In the senior year fifteen hours per week is devoted to electrical subjects, which comprise alternating currents and alternating-current machinery, power transmission, electrical machinery design, central-station design, operation and testing of dynamo-electric machinery. Besides these regular senior electrical studies, there is an opportunity for the student to select one or more elective studies from the following: Illuminating engineering, electric railways, telephony, electrochemistry; the choice of all these electives would require twelve hours per week.

There has been added to the laboratory equipment of the department, which already was exceptionally complete, a large number of standard and special instruments. A new calibrating table for testing and standardizing instruments is to be installed. The laboratory storage battery of sixty 240-ampere-hour cells has been completely overhauled and new charging and discharging facilities provided. An additional potential battery of 120 storage cells has been put in. Among the new machinery in the dynamo laboratory is a ten-kilowatt two-phase permutator and two single-phase railway motors.

As an indication of the character of the work done in the electrical department may be mentioned some of the titles of theses prepared by students of the electrical course that are about to graduate:

"The Effect of Frequency on Holding Power of Lightning Arresters;" "The Permutator (Rouge-Faget Type);" "The Characteristics of Magnetic Fields Within Conductors;" "The Electrification Project of the Chicago Suburban Service of the Chicago, Burlington & Quincy Railroad;" "The New York and Philadelphia Electric Railway Project;" "Conditions Influencing the Phase Angle Between Primary and Secondary Currents of Current Transformers;" "An Experimental Determination of the Possibilities of the Capillary Electrometer as an Oscillograph;" "An Experimental Study of the Globe Photometer;" "Electrification Project of the Illinois Central Railway Suburban Service at Chicago;" "A Complete Test and Report of the Knickerbocker Ice Company's Plant;" "Methods of Producing Quadrature Between the Fields of Alternating-Current Wattmeters."

At the thirteenth annual commencement, which will be celebrated on the evening of May 27, at Armour Assembly Hall, there will be graduated twenty-seven students in electrical engineering, nineteen in civil engineering, thirteen in mechanical engineering, seven in chemical engineering, four in fire-protection engineering and three in architecture. Advanced degrees will be conferred upon the following numbers of graduates: Electrical engineer, five; civil engineer, five; mechanical engineer, four; chemical engineer, one. The principal address at these exercises will be made by Dr. Charles F. Thwing, president of Western Reserve University, Cleveland, Ohio.

The staff of the department of electrical engineering, as reorganized for the next school year, is composed of: Ernest H. Freeman, professor of electrical engineering and director of the department; John E. Snow, associate professor; David P. Morton, associate professor; William E. Barrows, Jr., assistant professor; George E. Marsh and Harold W. Nichols, instructors. By special arrangement J. M. S. Waring, electrical engineer of the Chicago office of the Electric Storage Battery Company, will give a course of two lectures per week on electric railways. To those familiar with Armour Institute affairs the personnel of the department insures it a success beyond all measure of the excellent results already achieved.

Third Avenue Railroad Sale.

The decree of foreclosure against the Third Avenue Railroad, New York city, under the refunding mortgage of 1900, trusteed by the Central Trust Company of New York, was filed on May 17 with the clerk of the United States Circuit Court. Under the decree the property of the road is to be sold on September 2, 1909, on the steps of the County Court House, unless there is paid within twenty days the claim of the trust company for $37,560,000 for principal on the mortgage and interest at four per cent, since July 1, 1907, amounting all told to $40,381,-173.

The sale is made subject to the first lien of the $5,000,000 first-mortgage bonds of the Third Avenue Road, and the purchaser is to assume also all pending contracts and the obligations of the road on contract and tort claims. The purchaser will have to deposit $200,000 with the receiver of the railroad, Frederick W. Whitridge, before the sale of the physical property is made and $100,-000 before the securities are sold.

Canadian Electrical Association.

The annual convention of the Canadian Electrical Association will be held in Quebec on June 16, 17 and 18. The entertainment features will include: Seeing Quebec by electric cars, visit to the Chaudiere Falls, dinner at Kent House at Montmorency Falls, steamer trip around Quebec harbor, including bridge sight.

NEBRASKA ELECTRICAL ASSOCIATION.

SECOND ANNUAL CONVENTION AT OMAHA, NEB., MAY 11, 12, 13.

The second annual convention of the Nebraska Electrical Association was held at the Millard Hotel, Omaha, Neb., on May 11, 12, 13. President Bullock called the meeting to order at 2 o'clock Tuesday afternoon, May 11, the morning session having been postponed until that time, and introduced Mayor Dahlman of Omaha, who made a happy welcoming address, presenting the keys of the city to the delegates.

After the president's reply to the mayor's address, Thomas H. Fritts, of Grand Island, was voted temporary secretary in the absence of Secretary William Bradford, who was unable to attend on account of illness.

The president then addressed the meeting as follows:

PRESIDENT'S ADDRESS.

This completes the second year of our association work. I wish to congratulate you on both the loyalty and enthusiasm of our membership. Both of these qualities have been tested thoroughly during the past year, and each grade 100 per cent in efficiency and 100 per cent in the power factor. Much real progress has been made to improve our organization and to increase its efficiency.

There seems to be some misconception in the minds of the public as to the objects of this association—the impression seeming to be, in the minds of some, that it is for the purpose of raising prevailing rates for electric current. Nothing could be further from the truth. We have no intention of even attempting *uniformity* of rates, as such a thing would be impossible, as each central station has different cost elements, and different load factors—all of which enter into the basis upon which correct rates are made—or, at least, ought to be made. If one individual or corporation owned or controlled all of the electric-light plants in the state, there would be almost as many different rates as we have now. The only object of this Association with which I am acquainted is this:

Mutual improvement electrically, or, in other words, by interchange of ideas to become better central station operators, and to keep abreast of the times in all matters electrical.

On account of the high cost of coal in this state, engineering practices prevailing where coal is cheaper are not correct as applied to us.

On account of the progressive spirit of our citizens, making our load factor high in every town in proportion to its population, our conditions are different from nearly all other states.

So also the increasing and widening area of the usefulness of electricity is so rapid that we need each to assist the other in deciding upon the proper course of action in regard to the new things, and the new uses constantly coming up.

We can save each other large items of expense in experimentation if we can cooperate sufficiently so that we can act about these new things like we would if one of us owned all of the plants in the state.

If one of you owned all of the plants in the state, you would not try a certain new thing in all of them at once, would you? If there were three or four new things coming up at once, you would try one of them in one locality—possibly two—and so with each of the others. Why can't we, too, act in this manner, and thereby save ourselves a lot of unnecessary expense in trying what may have been the correct methods where they have been used in the East, but may not be right here? There is no excuse for all trying the same experiment at the same time.

We ought, in my opinion, to organize a *new business department* for the small plants in the state, and have a competent man to assist us in securing new business, each paying for the work done for his plant.

There is a great deal of business in your town that can be secured for you by some man who has no pecuniary interest in your plant, and who is a stranger to your customers. People are so apt to believe the stranger in perference to you, not because your reputation for truth and veracity is bad, but because anything you say is discounted.

I am a strong advocate of local newspaper advertising. Last year we used practically no other method of soliciting residence business, and our new customers from this source were almost double that of any other one year.

You can use this space not only to secure new business, but to keep your customers and the people in your locality acquainted with your plant. It gives them a personal interest in it.

You must get away from the theory advanced by Mr. Vanderbilt a great many years ago, that it is none of the people's business how you run your plant. It may not be any of their business, but they will make it their business if you act on any such hypothesis.

At our last annual meeting, we invited the cities and towns of the state operating electric properties to join our Association—in that way showing them our friendly interest, and offering them the benefit of our dearly bought experience in the operation of these properties, and expecting to get theirs in return. They have the same problems in the successful management of their properties that we have, and there is no reason, so far as I can see, why we may not be mutually helpful to each other. They want their plants to be financially successful as much as we want ours to be, and it seems to me that if we can overcome their prejudice and suspicion, the result would be of great benefit to us both.

Your president has some unusual views on the question of municipal ownership which can just as well be taken up here as later. I want to call your attention to the fact that, in my opinion, when you accept a franchise from a city for the privilege of using its streets and alleys for distributing electric current, and after you have gotten all of the "whereases" and provisions covering their use, and your rights and the city's rights, all stated carefully, there are still some other things that you have agreed to on your part which you will not find written in the agreement which you have entered into with the city. One of these is *adequate service*, that is, a plant big enough to supply the demands of the citizens as regards quantity, and a service which is for each of the inhabitants within the city limits, and delivered to his property upon the same basis, regardless of whether his business is on a service line, so that it will pay a profit or not.

You have agreed to grow and develop this property with the growth and development of the city. This means that if you put in a plant for a town with a population of 2,000, and a midnight service, that when this town becomes a city of 5,000 or more, you must have a plant suitable for a city of this size, and probably operating a twenty-four-hour service.

Again, you have agreed to give the citizens of the city or town good regulation and practically continuous service.

No city will be satisfied—and you ought not to expect it to be—with a service which is intermittent in its character.

Accidents will happen, but there is no

excuse for their being frequent; and you have agreed, as I stated before, that you will not have them happen.

Again, while it may not be stipulated in your franchise, you have agreed to give them reasonable rates. This question of rates is, of course, the most serious one with which you have to deal. But, to my mind, the question of rates is almost self-adjusting. In every community conditions are different, so that it is impossible to say from outside what would be the correct rate; but you will find that the lowering of some of your rates, especially to the long-hour customer, will give you the greatest return on your investment, and, when this is true, no one will discover it sooner than you yourselves.

It will not be nearly so hard to satisfy your *customers* with the rates they are getting as it is to satisfy yourself that you have established the right rate, because we all know that a rate too high is much more dangerous to the owner of the plant than to the consumers. The lower rate frequently may produce a greater net profit than a higher one. This is in your contract, although you possibly did not see it.

Now, where all of these "unwritten agreements" mentioned above have been fulfilled by the central station manager, have you ever known a municipal plant to be installed? I will confess that I do not know of such a case, and I do not believe that you do. Accepting this as true, it seems to me that the danger of municipal ownership to the central-station operator can be made very remote.

I think, also, that in your dealing with the city for the lighting of its streets that you should be more than liberal—doing the city lighting at very close to your cost.

You should also thoroughly familiarize yourself with the best plan for lighting the streets of the city you are operating in, and you should give them the benefit of this information.

Education among ourselves as to our accounting will help the sentiment which seems to be growing compelling municipal authorities to adopt methods of accounting which, if not the same as ours, will still produce the same results. Proper accounting will do much to educate the people as to just what their municipal plants are accomplishing.

Admitting that the people have rights which you are bound to respect in return for their giving you the use of their streets and alleys, still I cannot agree that the position taken by some of our courts, which seems to indicate a wrong view of the public service situation, is right. One case in point was where a gas company had been ordered by a municipal corporation of a sister state to make a ninety-cent rate. The Supreme Court of Iowa, passing upon this question, made use of the following statement:

"Government bonds bearing two per cent are selling above par. Railroad bonds, drawing four per cent interest, are also above par. Therefore it ought to be satisfactory to the investors of a gas plant if it makes six per cent. If, after a trial of the ninety-cent rate, you can bring your books into court and show that it does not produce six per cent, we will allow you to raise your rates."

Now, then, while this does not guarantee that the gas companies are to make six per cent during the trial period, it certainly takes away the incentive of the operator to look after economies. For if he is to make six per cent, and is only going to be allowed to make six per cent, why should he quarrel with his payroll? With the number of hours his men work? With the number of men employed? With the price of coke? With the price of gas mains, etc.? And why should he add to his work by keeping up a new business department if he is only to make six per cent, and the courts will allow him to raise his rates so he can make six per cent, why should he spend any time or mental effort in getting more people to use gas, making more work for his men, more meters to read, more accounts for the bookkeeper, more complaints to receive. Why not sit down and be satisfied with what comes to him, and even discourage those that come?

Does not this finally react upon the people themselves? And do not all of these so-called regulations, which result in hampering the development of these properties, finally react upon the people themselves?

Who would have invested their money in public-utility corporations and have developed these properties if the state had said six per cent is your maximum return on these investments?

And where is the money for those dividends that were passed in the early history of all these companies? And where is the money for the risk that was taken that these properties would not pay?

No question is settled until it is settled right. And no question is settled right when it is settled by arbitrary action. And a statement that ninety cents is right because it looks to the court as if it would make six per cent is nothing but arbitrary action.

It seems to me that the correct method for municipalities to adopt in determining rates, if it is admitted that they have the right, is to take plants of the same size in the United States that are being operated by municipalities themselves and have experts decide what it is costing those people to operate those plants; and, if we are furnishing the service as cheaply as they are, everything considered, they ought to be contented—that is, that when they consider depreciation, maintenance and taxes; if we are willing to meet those conditions, they should be both satisfied and contented.

The great difficulty with us and with them is that we do not take into consideration the proper depreciation charge. This is the rock upon which many of our hopes are finally blasted.

The constant changes in the efficiency of machinery have made, especially up to the present time, depreciation very high.

The increasing cost of coal is also making obsolete a great deal of machinery that up to ten years ago was considered up to date. The outgrowing of machinery by the growth of your city adds again to this account.

I have not heard of a municipality going into the gas business and staying permanently and furnishing gas for the rates they are compelling in some places, without making a heavy drain upon the citizens by means of taxation.

I think the time has come when this issue should be fairly drawn whether or not the operators of these properties are to receive anything for the personal element—for their wisdom as operators, or pay for their lack of wisdom; or whether these properties are all to be equalized and operated on about the same plan that municipal operations are.

It would be much easier for us to operate the plants under the latter method—that is, it would not take so much worry or mental effort.

I hope that the central-station managers present will each do their share to make the meeting a success, and in that way derive the greatest benefit from the association themselves. I am sure that the two years that we have been in existence have promoted a harmonious feeling and a unity of action which cannot help but be of great benefit to us in the future.

In conclusion, I wish to thank the members of the association for their uniform promptness in assisting me in the discharge of my duties during the past

year and to bespeak the same for my successor.

After the reading of President Bullock's address a committee was appointed to consider the points involved and bring them before a later session for discussion.

Morgan P. Ellis, of Chicago, then read an interesting paper on the "Relation of the Holophane Prismatic Reflector to the New High-Efficiency Units." Mr. Ellis said in part:

"Since the advent of the new high-efficiency units the standard of illumination has been constantly rising, so that today a progressive merchant is satisfied with nothing but the best. Central-station managers have now convinced themselves that the latest development in the art of lamp making, namely, the tungsten lamp, is a very good investment for both themselves and their customers, and today the most skeptical are pushing this new lamp for all it is worth.

"Illuminating engineers have made it possible by compiling data and formulas for any central-station or new business manager to calculate mathematically the wattage required to illuminate any given space scientifically. With this knowledge and the little care in distributing the units a most perfect illumination can be obtained.

"Inasmuch as the filament of the new lamp is perpendicular and the rated candlepower is given off horizontally, the use of a reflector of some sort is necessitated in order to redirect the light rays to the plane of illumination.

"The lamp companies and eminent engineers of this country have standardized the Holophane prismatic reflector as the proper one to use, inasmuch as that is the only reflector which is calculated to a known distribution. In November, 1908, the Holophane Company made some sweeping changes in its high-efficiency glass, having in mind the fact that the bowl-type reflector (which successfully hides the intense brilliancy of the unit) could be so calculated as to give any one of the three distributions required by illuminating engineers in their work, namely, the extensive, intensive and focusing type of distribution.

"In this new line of reflectors the merging prism has been utilized, inasmuch as it adds to the reflecting powers as well as to the beauty of the reflector. This line of reflectors is calculated for the 25, 40, 60 and 100-watt tungsten lamp, and includes one large bowl-type reflector for the 250-watt lamp.

"The extensive type of reflector will give an increase of 230 per cent over the bare filament between the angles of 0 and 60 degrees from the perpendicular. The basic application of this type of reflector is in the lighting of modern-sized rooms with single units or groups of units.

"The intensive type will show an increase of 460 per cent over the bare lamp between the angles of 0 and 45 degrees from the perpendicular, giving practically the same distribution as the old bowl-type reflector. This type of reflector was designed primarily for the illumination of large areas, such as large stores, dining halls, etc., where the units are placed well up toward the ceiling.

"The focusing type is, as its name implies, a concentrator, and should be used in such places as display windows, counters, desks, etc.; in fact, wherever the spotlight effect is desired. This type will show an increase of 1,200 per cent over the bare lamp at ten degrees from perpendicular.

"To those desiring a more perfect diffusion than is afforded by the use of clear glass the satin or enamel finish is recommended. In the use of either of these finishes it is true that a small percentage (approximately fifteen per cent) of the efficiency is lost, due to the absorbing qualities of the finish, and that the curve is a little less broad; but these differences are hardly appreciated and are not entirely lost sight of when softer diffusion and artistic effect is considered.

"In using the Holophane reflector great care should be taken to use the proper holder, as an entirely different distribution from that desired is obtained by the use of the wrong one. The form 'H,' or extension holder, should be used with all tungsten lamps which have the skirted base, and the form 'O' or regular two-and-one-half holder with lamps which have the regular carbon bases, such as the new twenty-five and forty-watt lamps.

"The frosted tip lamp should always be used whenever possible, inasmuch as it affords a better diffusion for the intense rays of the new lamp. This is a matter which should not be lost sight of, inasmuch as the better diffusion we have the higher the standard of our illumination, and it should be the aim and desire of everyone connected with the lighting industry to raise that standard as high as possible."

The paper was followed by a general discussion.

A paper on "Relation of the Nebraska Electrical Association to Public-Service Legislation" that was to have been read by Secretary Bradford was necessarily omitted on account of the secretary's absence, B. C. Adams, of Lincoln, reading as a substitute abstracts from a paper read by Mr. Doherty before the Wisconsin Gas Association at Milwaukee last May on "Present-Day Tendency on Rates," which invoked an animated discussion.

After this the convention adjourned until the following day at 10 a. m.

Tuesday evening a banquet at Hansen's cafe was tendered the members of the association by the Electrical Show management, at which George W. Johnston acted as toastmaster.

WEDNESDAY MORNING SESSION.

After the appointment of financial and nominating committees a short paper on "Ice Plants," by L. J. Schwingel, of Holdredge, opened the Wednesday morning session, followed by a discussion, in which the president and others took part.

President Bullock then gave an interesting talk on "Economy of Operation."

After a discussion on this subject and after a motion was made and passed to accept an invitation to visit the plants of the Omaha Street Railway Company at the close of the afternoon meeting, the morning session was adjourned.

WEDNESDAY AFTERNOON SESSION.

The afternoon session was opened by a motion from E. J. Sullivan that a committee be appointed by the association to draw up a resolution to the effect that it was the sense of the meeting that state regulation of public-service companies be favored.

This was warmly debated and finally laid on the table with an understanding that it be brought before the association at its next annual meeting.

H. A. Holdredge, of Omaha, then moved that a committee be appointed to "consider the advisability of affiliating this association with the National Electric Light Association," which was carried.

H. C. Porter, of Lincoln, then read a paper on "New Business," and a general discussion took place, in which the advantages of newspaper advertising, house-to-house soliciting, use of tungsten lamps, etc., were brought forth.

The discussion was followed by the election of officers for the next year, resulting as follows:

President—B. C. Adams, of Lincoln.

Vice-President—Joel M. Roberts, of York.

Secretary—Frank McMaster, of Beatrice.

Treasurer—L. J. Schwingel, of Holdredge.

The afternoon session was then adjourned to enable the visitors to visit the street-railway company's power plant.

In the evening the Sons of Jove held a rejuvenation, Chauncey L. Hight, of Boston, doing the work of organizer and taking the part of Jove in the rejuvenation.

THURSDAY MORNING SESSION.

The session opened with the report of the auditing committee, which was adopted, the secretary's report being deferred on account of his illness.

An amendment to the by-laws was then adopted to the effect that municipal electrical inspectors, by virtue of their office, be honorary members of the association.

Frank McMaster followed with an interesting talk on his experiences in connection with the work done by his company in testing meters on the consumer's premises.

The committee appointed to report and act on the president's address then made a favorable report, which was preceded by a discussion, in which President Bullock defended his recommendations.

Word having been received that H. E. Babcock would be unable to attend and present his paper on "Waterpower in Nebraska" at the afternoon session, it was decided to dispense with the afternoon session and the convention then adjourned, leaving the place of next year's meeting open.

In addition to those already mentioned last week as attending the Omaha Electrical Exposition the following representatives of supply houses and manufacturers also attended the convention and the show during the week: Milo D. Eames, Buffalo, N. Y.; W. H. Fox, representative of the Fort Wayne Electric Works in Iowa and Nebraska; Frank S. Vecmeyer, representative of the Fort Wayne Electric Works, Des Moines, Iowa; Fred T. Benson, of the Chicago office of the General Electric Company; Cameron MacIntyre, of the Illinois Electric Company, Chicago, Ill.; B. H. Chase, of the Interstate Supply Company, Sioux City, Iowa; R. L. Wildauer, of the Chicago office of the American Circular Loom Company of Boston, Mass.; W. J. McFadden, of the Sterling Electrical Manufacturing Company of Warren, Ohio; Charles C. Fricke, of the Phœnix Glass Company, Chicago, Ill.; H. W. Steffen, of the Lincoln Pole Wrapper Company, Lincoln, Neb.

Colorado Adopts Strict Measures Against Theft of Electricity or Gas.

The State Legislature of Colorado has recently passed two bills introduced by Senator Bardwell which are intended to make it a punishable offense to interfere with, or attempt to steal from, any supply of electricity or gas. The first act declares it a misdemeanor for any person to make any connection with any wire, instrument, motor or other electrical device, without the knowledge or consent of the owner of such wire, motor or device; to arrange without consent any means whereby current that should be measured or registered by a meter is made to pass around such instrument; or to alter, obstruct, or interfere with the action of any meter without proper authority. Proof of the existence of any wire connection or of any injury, alteration or obstruction of a meter is taken as prima facie evidence of the guilt of the person in possession of the premises. Punishment for each offense is by a fine of not less than $50, nor more than $300, or by imprisonment from thirty to ninety days, or by both fine or imprisonment.

In the second act similar provisions are established for interference with, or theft from, any supply of gas, and similar punishments are provided for each offense.

Electric Furnaces for United States Steel Corporation.

Of the two large electric furnaces to be installed by the United States Steel Corporation, one is to be located at the south works of the American Steel and Wire Company at Worcester, Mass. The electricity to operate the plant will be delivered from the Connecticut River Power and Transmission Company.

College to Teach Wireless.

Engineers in wireless telegraphy will be trained in the engineering department at Ohio State University. The first class will start with the third term in the next college year.

A complete equipment will be installed, capable of communicating with the wireless stations at Cleveland, Detroit, and other points on the Great Lakes.

Government Consents to Tunnel Work.

Robert Shaw Oliver, acting War Secretary, has given permission to the New York Public Service Commission for the construction of the four-track tunnel which ultimately is to connect the Manhattan and Bronx divisions of the Broadway-Lexington Avenue subway, New York.

Nebraska Telephones and Trolleys.

The first report of the Nebraska State Railway Commission, covering the year ended June 30, 1908, has been made public. It shows:

Of subscribers living on farms there were 54,338, indicating that conversation between rural residents can be carried on from farm to farm with as much celerity and almost as generally as in the thickly-populated city. Of city subscribers there were 36,917, or 17,421 less than the number taking telephone service on the farms of Nebraska. Of course, the larger number credited to farms cover a tremendous extent of territory. In all there were 125,209 telephones installed at the date mentioned.

The fifty-two companies with the higher capitalization represented an investment of $9,747,353 for construction and $10,858,139 for plants, buildings, cash and all other assets, a total of $20,605,792 as carried on the books of the companies.

The 156 companies with the smaller capitalization gave the book cost of construction as $1,388,771.

Gross earnings for the year of the fifty-two larger companies amounted to $2,401,896, while operating expenses were set down at $1,798,427. Dividends on stock and interest were paid to the amount of $483,219 by thirty-seven of the fifty-two larger companies.

Gross earnings of the 156 smaller companies amounted to $428.896, while the expense of operation was set down at $297,457.

This report shows that there are six electric railways doing business in the state, two being credited to Omaha and four to Lincoln; the passengers carried for the year aggregated 51,182,242; capital stock, $16,944,648; stockholders, 693; assets, $28,957,175.60, and liabilities, $28,977,890.82; miles of track operated, 186; gross earnings of six companies, $2,711,238.83; net income of six companies, $1,397,853.94.

Metropolitan Sale Postponed.

Judge Lacombe, of the United States Court in New York, has ordered the postponement of the sale of the Metropolitan Street Railway property until June 29, owing to the improbability of the Appellate Court rendering a decision in the case of the Guaranty Trust Company before June 1, the date originally set for the sale. This suit was brought in the interest of the bondholders.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION.

FOURTH ANNUAL CONVENTION AT INDIANAPOLIS, IND., MAY 12 AND 13.

The fourth annual convention of the Indiana Independent Telephone Association was held at the Claypool Hotel, Indianapolis, Ind., May 12 and 13. The attendance was good and an excellent programme was carried out, making it by far the best annual meeting held by the Association.

The convention was called to order by Charles S. Norton at 10 a. m. on Wednesday, May 12. An address of welcome was made by City Attorney C. D. Bowan, representing the mayor, and responded to by Allen J. Payton, of Rockville. Mr. Bowan was felicitous and declared that the independent telephone service of Indiana had done more to make Indianapolis the great social and financial center that it is than any other industry. "No set of men," said he, "is entitled to a more generous welcome to the capital city than the telephone men." In responding, Mr. Payton said the benefits alluded to were reciprocal and mutual. The whole state claims Indianapolis, and whatever is beneficial to the one is beneficial to the other.

President Charles S. Norton delivered the annual address, giving an interesting and concise review of the work of the year. He said there had been a gratifying increase in the number of independent companies and independent subscribers in the state during the year, bringing the total up to about 223,000, or one telephone to every eleven persons in the state. He pointed out that while other public-service institutions were compelled to enter upon a policy of retrenchment telephone companies had been expanding and the receipts growing larger and the business more stable.

The main interest of the first session centered in the reports of the district vice-presidents. The reports relating to the condition and progress of independent telephone companies in the eleven districts were very gratifying. Everyone of the vice-presidents reported an increase in the number of telephones, the number of miles of circuit cable constructed and other improvements. The reports also showed that the companies had made money notwithstanding the business depression and the impairment of property by reason of severe recurrent storms.

The pleasant feature of the first day's session was the annual dinner at the Claypool on Wednesday evening. Hon. James P. Goodrich acted as toastmaster, and a number of eloquent after-dinner speeches were made. One of the most noteworthy of these was by James S. Brailey, Jr., the head of the independent telephone interests in Ohio and Indiana. Mr. Brailey had, as his subject, "Telephone Securities." He said it was extremely gratifying to note that telephone securities presented the best and most attractive investment on the market today. As compared with other public-service securities he considered telephone securities were the most stable and salable. The stability of the earnings of the telephone companies made them so. A further reason was that the telephone companies were owned by home people and not by capitalists down in Boston. Mr. Brailey arraigned the Bell Company for its lavish expenditure of money in a vain effort to stamp out independent companies, the strength and popularity of which are growing every day.

THURSDAY'S SESSION.

The second day's session was devoted to the reading of valuable and instructive papers by Walter Uhl of Logansport, Thos. D. Sherrin of Covington, Theodore Thorward of South Bend, J. W. Coffey of Indianapolis and a talk on telephone law by Thos. E. Davidson of Greensburg. Mr. Coffey's paper related to the methods of the telephone clearing-house, in which he took occasion to assert that the clearing-house branch of the association is absolutely necessary to the perpetuity and success of the telephone business in this country.

The nominating committee recommended the re-election of C. S. Norton as president and A. J. Payton as secretary, and this was done by a unanimous vote. The next convention will be held in May, 1910, at South Bend, at which time and place the Michigan Association will hold its annual convention, and joint sessions will be held.

The supply men made a very creditable exhibit of new and improved equipment, showing that inventive genius has been busy in bringing out the improved apparatus that makes the telephone system almost perfect in every particular. S.

Better for Business.

President G. Tracey Rogers, of the Rutland (Vt.) Railway, Light and Power Company, in a recent interview, declares that with every extension of the electric railway system, there has been an increase of Rutland's business field.

Would Protect the Common.

In Boston an injunction has been issued against the Boston Transit Commission and the City of Boston, seeking to prevent the building of a tunnel under the Common to connect with the Cambridge subway. The contractor has been made a party to the proceedings, as Corporation Counsel Babson has stated that unnecessary delay in carrying out the contract would render the city liable in damages. The petitioners claim the contract has not been delivered to the contractor, so is not in force. If the judge finds the contract is in force an injunction will issue against the contractor while the case is pending before the full bench of the Supreme Court, to which it will go for determination. If the judge finds that no valid contract exists all the defendants will be restrained from making one and the work will be stopped during the pendency of the action.

Judge Braley, in granting this injunction, declared that he was satisfied the petitioners had an honest and serious purpose and they desired to protect the Common against encroachments which, beginning in a small way, eventually might absorb the greater part of the Common.

London Likes American Methods.

W. B. Parsons, now a London underground tube director, said in a recent interview:

"Traffic returns and increased net earnings demonstrate that the way the underground systems are now worked out is the right one. Elevators at tube stations no longer crawl up and down; trains travel faster and on shorter headway, and stops at all stations are very brief.

"Londoners can get about now with as little waste of time as in New York and Chicago. Cars built on the American pattern and the disappearance of the three classes of accommodation have appealed to Londoners."

Electric Safety Device.

The Simmen automatic safety device, installed on the Atchison, Topeka & Santa Fe Railway in California some months ago, has proven satisfactory.

This new invention entirely dispenses with the telegraph operator. Each train as it passes over the road automatically makes a record on a sheet in the train dispatcher's office. By means of red and green lamps and a gong the dispatcher can at any time signal direct to the engineer to stop, slow down or proceed.

Smokeless Combustion of Coal in Boiler Plants.

A bulletin on the smokeless combustion of coal in boiler plants with a chapter on central heating plants has just been issued by the United States Geological Survey, Technologic Branch, giving in detail a study of the conditions found in industrial establishments in thirteen of the largest cities of Indiana, Illinois, Kentucky, Maryland, Michigan, Missouri, New York, Ohio, and Pennsylvania, between 400 and 500 plants having been inspected. Sufficient information was collected to make the data from 284 plants of value for this report.

The bulletin, prepared by D. T. Randall and H. W. Weeks, not only shows that bituminous coals high in volatile matter can be burned without smoke, but also that large plants carrying loads that fluctuate widely, where boilers over banked fires must be put into service quickly and fires forced to the capacity of their units, can be operated without producing smoke that is objectionable. Proper equipment, efficient labor, and intelligent supervision are the necessary factors.

A brief summary of the general conclusion is as follows:

A well-designed and operated furnace will burn many coals without smoke up to a certain number of pounds per hour, the rate varying with different coals, depending on their chemical composition. If more than this amount is burned, the efficiency will decrease and smoke will be made, owing to the lack of furnace capacity to supply air and mix gases.

High volatile matter in the coal gives low efficiency, and vice versa. The highest efficiency was obtained when the furnace was run at low capacity. When the furnace was forced the efficiency decreased.

With a hand-fired furnace the best results were obtained when firing was done most frequently, with the smallest charge. [This is not necessarily true in all cases. —Ed.]

Small sizes of coal burned with less smoke than large sizes, but developed lower capacities.

Peat, lignite, and sub-bituminous coal burned readily in the type of tile-roofed furnace used and developed the rated capacity, with practically no smoke.

Coals which smoked badly gave efficiencies three to five per cent lower than the coals burning with little smoke.

Briquets were found to be an excellent form for using slack coal in a hand-fired plant. They can be burned at a fairly rapid rate of combustion, with good efficiency and with practically no smoke. High-volatile coals are perhaps as valuble when briquetted as low-volatile coals.

A comparison of tests on the same coal washed and unwashed showed that under the same conditions the washed coal burned much more rapidly than the raw coal, thus developing high rated capacities. In the average hand-fired furnace washed coal burns with lower efficiency and makes more smoke than raw coal. Moreover, washed coal offers a means of running at high capacity, with good efficiency, in a well-designed furnace.

Forced draft did not burn coal any more efficiently than natural draft. It supplied enough air for high rates for combustion, but as the capacity of the boiler increased, the efficiency decreased and the percentage of black smoke increased.

Most coals that do not clinker excessively can be burned with one to five per cent greater efficiency and with a smaller percentage of black smoke on a rocking grate than on a flat grate.

Air admitted freely at firing and for a short period thereafter increases efficiency and reduces smoke.

As the carbon monoxide in the fuel increases the black smoke increases. The percentage of carbon monoxide in the flue gas is, therefore, in general, a good guide to efficient operation. However, owing to the difficulty of determining this factor, combustion cannot be regulated by it.

The simplest guide to good operation is the number of pounds of coal burned per square foot of grate surface per hour.

Some general conclusions from the facts set forth in the bulletin are as follows:

The flame and the distilled gases should not be allowed to come into contact with the boiler surfaces until combustion is complete.

Firebrick furnaces of sufficient length and a continuous, or nearly continuous, supply of coal and air to the fire make it possible to burn most coals efficiently and without smoke.

Coals containing a large percentage of tar and heavy hydrocarbons are difficult to burn without smoke and require special furnaces and more than ordinary care in firing.

Briquets are suitable for use under power-plant conditions when burned in a reasonably good furnace at the temperatures at which such furnaces are usually operated. In such furnaces briquets generally give better results than the same coal burned raw.

In ordinary boiler furnaces only coals high in fixed carbon can be burned without smoke, except by expert firemen, using more than ordinary care in firing.

Combinations of boiler-room equipment suitable for nearly all power-plant conditions can be selected, and can be operated without objectionable smoke when reasonable care is exercised.

Of the existing plants, some can be remodeled to advantage. Others cannot, but must continue to burn coals high in fixed carbon or to burn other coals with inefficient results, accompanied by more or less annoyance from smoke. In these cases a new, well-designed plant is the only solution of the difficulty.

Large plants are for obvious reasons usually operated more economically than small ones, and the increasing growth of central plants offers a solution of the problem of procuring heat and power at a reasonable price and without annoyance from smoke.

The increasing use of coke from by-product coke plants in sections where soft coal was previously used, the use of gas for domestic purposes, and the purchase of heat from a central plant in business and residence sections, all have their influence in making possible a clean and comfortable city.

Trolley Lines and Land Values.

The development of the country and the increase in the value of land brought about by the extension of interurban electric railways is in some sections truly remarkable.

Electric lines leading out of Portland, Ore., for example, have multiplied the value of land within several miles on each side of their rights-of-way, and the large farms and unused clearings of two years ago are now being cut up into acreage tracts and converted into cozy homes. Land that in 1906 could be purchased for $25 to $50 an acre now sells for $200 and $300, and the improvement of the small tracts sold tends to a still further advance in the value of property adjoining.

The eastern portion of Multnomah County, northern part of Clackamas and the eastern portion of Washington County are evidences of what can be done by lines of rapid transit in the matter of increasing values. Wherever the land is level or gently rising, new homes are springing up and new orchards are being planted.

New 300-Horsepower High-Pressure Fire-Service Pumping-Station for Philadelphia.

During March an important contract was closed by the city of Philadelphia for the equipment of a new high-pressure fire-service station, practically a duplicate of the Delaware Avenue fire station which has been in service for a number of years past with great success.

The new plant will be located at Seventh and Lehigh avenues, in the Kensington mill district. It will use water from the old Fair Hill reservoir entirely, as it is located some distance from the river.

The work is in charge of the Millard Construction Company, which is the general contractor, while detail engineering work is being carried out by the Scofield Engineering Company.

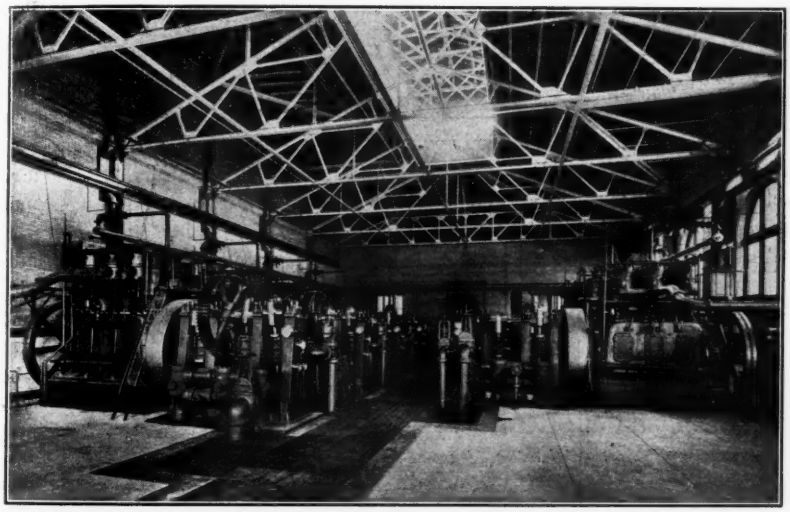
The first contract covers ten 300-horsepower Westinghouse vertical single-acting gas engines, direct-connected to Deane triplex pumps; and in addition a 140-horsepower unit for auxiliary purposes. The equipment is practically a duplicate of the Delaware Avenue station. It will take its fuel gas from the city gas mains, and, as in the case of the Delaware Avenue station, two large holders at different points in the city are available to be drawn on for the supply.

The decision to employ again gas-engine-driven pumps for this high-pressure fire service is distinctly interesting in view of the discussion which took place previous to and after the installation of the Delaware Avenue station, and was mostly in favor of electrically driven pumps as established in New York city.

A study of the first year's operation (1904) of the Philadelphia station shows the character of results that are obtainable from an installation of this kind. As this was the first year's operation of the plant, it was to be expected that the maximum interference from troubles, operative and otherwise, would be encountered. The year's record shows not a single case of failure to start, either in the actual fire service or in the numerous experimental runs which were made to test out the equipment. During the year there were thirty-two alarms and nine actual services of any considerable duration, the services varying from a few minutes to twenty-four hours. The large pumping units ran 337 hours and the small units 198 hours during the year, with a total pumpage of 27,000,000 gallons. The average cost per thousand gallons pumped, including all the experimental runs, which were by far the major portion of the service, was 12.5 cents; but for a large fire of five or six hours' duration the cost of pumpage is barely over five cents per thousand gallons. On the average any unit could be put upon the system at 300 pounds delivery pressure in from forty-five to sixty seconds from the time of giving the signal from fire headquarters. Moreover, the entire station could be gotten under way in from seven to ten minutes.

In ordinary operation, however, only one or two units are started on the first signal, as these are sufficient to start operations, and further units can be put on as the service may require. The cost of power is practically proportional to the pumpage. The total cost of repairs on the gas engines, totaling 3,000 horsepower, from their installation up to December, 1905, was $3.05. The system of compressed air for starting the gas engines has never given out when called upon, and the storage pressure of 200 pounds may be replaced within one or two minutes after the starting of the single engine. In fact, seven large engines at Philadelphia have been started with only ninety-eight pounds drop, without assistance from the compressor. In practice several of the storage tanks are always held in reserve for use only in case of a serious breakdown of the compressor.

Likewise, the gas supply has never failed. Considering that at least two large sources may be drawn upon, it is considered quite as dependable as electricity from underground feeders. The most interesting feature of the Philadelphia situation is the attitude of the insurance authorities. Prior to the establishment of the Delaware Avenue station the insurance underwriters had imposed an additional charge of twenty-five cents per $100. On the completion of the test of the high-pressure pipeline, in May, 1902, a first reduction of fifteen cents per $100 was made. On the final test of the gas-power station on April 18, 1905, the balance of the extra "pink-slip" charge was removed and the system was declared approved. Formerly of a most decided conservatism toward gas engines, the authorities then expressed their complete confidence in the new system by suggesting extensions to the initial system. The closure of the recent contract brings these suggestions into material form, and the net result will be a general reduction



INTERIOR OF HIGH-PRESSURE FIRE-SERVICE PUMPING-STATION, DELAWARE AVENUE, PHILADELPHIA.

TEST OF HIGH-PRESSURE STREAM OUTSIDE CITY HALL, PHILADELPHIA.

in fire rates in the districts affected in addition to the protection afforded.

The accompanying illustrations show, in a general way, the character of the Delaware Avenue station and the result of a test of one of the high-pressure streams at a point farthest from the pumping station, fifteen blocks from the river front. This station is under the control of the Department of Public Safety, of which Henry Clay is the director.

General Electric Company's Exhibit at Alaska-Yukon-Pacific Exposition.

The General Electric Company's exhibit at the Alaska-Yukon-Pacific Exposition will cover a floor space of 1,400 square feet in the machinery hall and will consist mainly of various supplies, together with some larger apparatus of particular local interest, such as mine locomotives, mine hoist equipment, electric air drills, etc.

The small material exhibit will include a display of domestic applications of small motors, arc and incandescent lighting apparatus and supplies, heating devices, oil switches, circuit-breakers, rectifiers and other devices of general interest.

The booth will be given a charming Dutch treatment throughout and will, in addition to open floor space for the heavier material, consist of two rooms, one of which will be used for the complete display and demonstration purposes of cooking and heating devices and the other for a reception room.

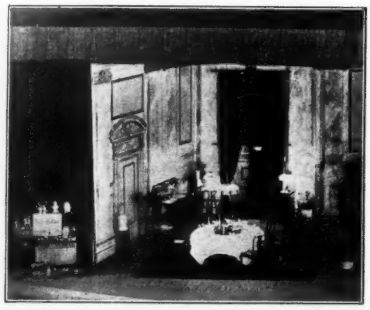
Commercial Activity of Wireless Companies.

As showing the development of wireless telegraphy as a commercial proposition it is interesting to note that at a recent call for bids by the United States Navy Department for the installation of seven complete wireless outfits at the Brooklyn Navy Yard, no less than nine firms responded. These were: International Telegraph Construction Company, Jersey City, N. J.; Marconi Wireless Telegraph Company of America, New York, N. Y.; Massie Wireless Telegraph Company, Providence, R. I.; Radio Telephone Company, New York city; Stone Telegraph and Telephone Company, Boston, Mass.; National Electrical Signaling Company, Pittsburg, Pa.; Telefunken Wireless Telegraph Company, Philadelphia, Pa.; Prague Electric Company, Providence, R. I.; W. L. Walker, Boston, Mass.

Mammoth Demonstrations of Electric Household Appliances at Denver.

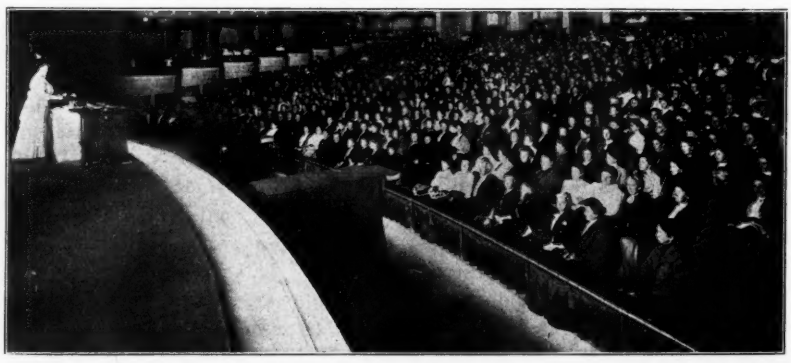
The Denver Gas and Electric Company, of Denver, Colo., has recently scored a remarkable success in its attempts to bring before the public notice its special appliances for household use.

For two weeks during the latter part of April Mrs. E. O. Hiller, a demonstrator of national reputation, gave a series of cooking lessons which covered



PORTION OF THE STAGE DEVOTED TO HOUSEHOLD ELECTRIC APPLIANCES.

every subject of cooking. Nearly half of her time was devoted to the demonstration of electrical cooking appliances and the various appliances used to lighten the work in the household. The first few demonstrations were held in the assembly hall of the company, but this was found to be too small and the public was asked to go to the Brown Hotel. This also proved inadequate for the large number who wanted to see the various appliances demonstrated, and the company hired the



DENVER GAS AND ELECTRIC COMPANY'S COOKING DEMONSTRATION AT THE DENVER AUDITORIUM.

Auditorium, where the national Democratic convention was held last year. At this place the average daily attendance was about 5,000. At the only evening session held, and which was given over entirely to electrical appliances, the attendance was in the vicinity of 10,000. The management of the company believes that it has never done anything more effective to draw the attention of the Denver women to its cooking appliances, and large sales are now reflecting the good that was done by the demonstrations.

Boston's Lights Tested.

That it pays to advertise was readily proved by the enormous crowd that gathered in Copley Square, Boston, on the evening of May 8 to witness a demonstration of the relative values of two kinds of electric lamps. The exhibition was given with the authority of city officials and was for the purpose of demonstrating the superior illuminating power and quality of the new General Electric flaming lamps over the old Gilbert arc lamps.

In the square there have recently been installed three of the flaming-arc lamps that are to take the place of the seven Gilbert lamps. At 7:45 and 8:15 p. m. the flaming-arc lamps were turned out for five-minute periods and the Gilbert lamps turned on, and the light which the Gilbert lamps shed seemed like the glow of candles compared with the flaming arc.

The claim of the Edison Electric Illuminating Company that Copley Square is now the best lighted square in the world, not excepting the famed Brandenburger Square in Berlin, is indorsed by Superintendent of Streets Guy C. Emerson, who says:

"We intend to make Boston the best lighted city in the country. Sixty of these flaming arcs are to be placed in all the squares and parks of Boston."

The flaming arcs in Copley Square will have ornamental poles of cast-iron. The Edison Company claims these three arc lamps, at a cost of only $468 per year, give twice as much brilliance as the seven old Gilberts, which have cost $828 annually.

The elevation of fifty-two feet equal to one-fourth to one-fifth the distance between lamps greatly helped.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER X. CIRCUIT-GOVERNING DEVICES.

AUTOMATIC POTENTIAL REGULATORS.

Accurate regulation of the voltage of alternating-current generators is of very great importance. Mostly all motors, lamps, etc., on such circuits operate at a maximum efficiency at definite voltages and it is therefore advisable to provide means for maintaining a constant voltage. For this purpose a number of potential regulators have been devised. There are

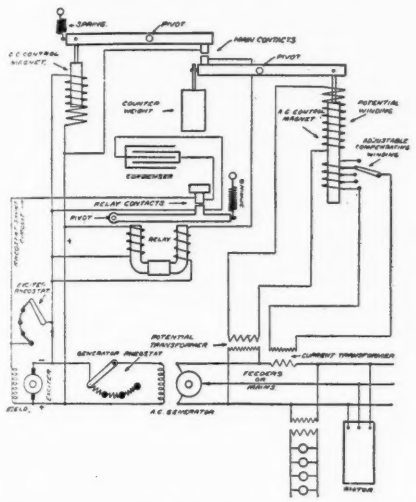


FIG. 192.—CONNECTIONS FOR A TIRRILL REGULATOR.

two types of regulators: (1) Regulators of the potential of the generator; (2) regulators of the feeder potential.

Tirrill regulator.—The connections of this type of regulator of the generator potential are illustrated in Fig. 192. The alternating-current generator is shown near the bottom of the figure. To the right are shown the feeders or mains, to

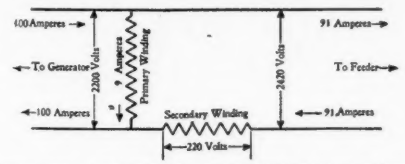


FIG. 193.—DIAGRAM OF REGULATOR RAISING VOLTAGE TEN PER CENT.

which are connected electric lights and a motor as load as well as a current transformer and a potential transformer for the regulator circuit. To the left of the generator is shown the generator field rheostat, the exciter and the exciter field rheostat. At the top are two lever arms oscillating on pivots, their adjacent ends forming the main contact and opposite ends actuated by solenoids, one being connected to the exciter circuit and the other to the main circuit.

With low voltage the position of the main contacts is lower down, as the direct-current control-magnet plunger is drawn up, the exciter voltage being low, as is also the plunger in the solenoids connected to the mains; the pull of the coil is then much weaker than at high voltage, when the main contacts are raised. As long as the main contacts are together the relay is energized and the relay con-

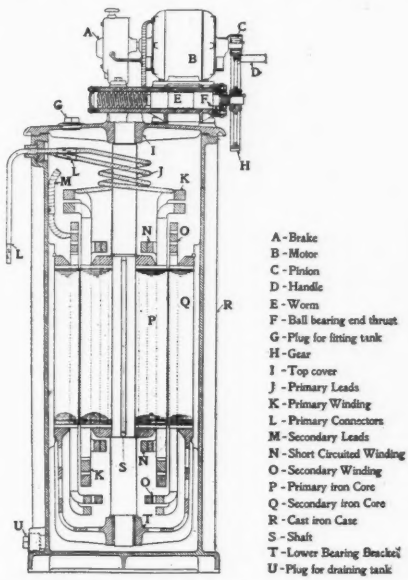

A - Brake
B - Motor
C - Pinion
D - Handle
E - Worm
F - Ball bearing end thrust
G - Plug for fitting tank
H - Gear
I - Top cover
J - Primary Leads
K - Primary Winding
L - Primary Connectors
M - Secondary Leads
N - Short Circuited Winding
O - Secondary Winding
P - Primary iron Core
Q - Secondary iron Core
R - Cast iron Case
S - Shaft
T - Lower Bearing Bracket
U - Plug for draining tank

FIG. 194.—CROSS-SECTION OF SINGLE-PHASE MOTOR-OPERATED INDUCTION REGULATOR.

tacts are separated. When the main contacts are apart, the relay contacts are closed and the exciter field is short-circuited long enough to raise the exciter voltage, which opens the main contacts through the direct-current control magnet. The rheostat in the exciter field is adjusted so that when thrown in it reduces the exciter voltage to about thirty-five per cent of normal. It is to be understood that the relay contacts short-circuit the exciter field rheostat only momentarily; in fact, the entire action of the regulator is accomplished so quickly that there is no appreciable change in the voltage of the alternator. This short-circuiting of a resistance at regular intervals is equivalent to varying the resistance, as already explained. The condenser is connected across the relay contacts to take up the field discharge on opening the rheostat shunt circuit.

Induction regulators.—Induction regulators offer a means of varying the voltage of an alternating-current circuit by means of the variable ratio transformer principle. The regulation of a single-phase circuit is effected by altering the position of a coil in a magnetic field. The efficiency of this type of regulator is high, being comparable to that of a standard transformer.

The action of a single-phase regulator is illustrated in Fig. 193. The primary winding is wound for the full potential of the line and is connected directly across, as shown. It acts as the exciting coil of the secondary, which is connected in series and carries the entire current. The primary coil generates a magnetic flux which penetrates the secondary and produces a change in the voltage of the

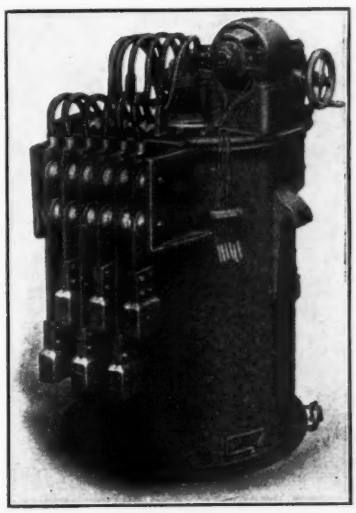


FIG. 195.—SIX-PHASE MOTOR-OPERATED INDUCTION REGULATOR.

coil depending on the magnitude and direction of the magnetic flux. In the neutral position the primary has no effect on the secondary coil and the voltage remains unchanged. By rotating the primary either way from the neutral position a voltage is impressed on the series coil which either increases or decreases the feeder voltage. Fig. 193 illustrates the current and voltage conditions for increasing the feeder voltage ten per cent.

When the regulator is in its neutral position the primary does not induce any voltage in the secondary, the latter then tends to create its own field and acts as a choke coil. A short-circuited winding must therefore be introduced at right angles to the exciting winding; it acts similarly to a short-circuited secondary of a series transformer in eliminating the choking effect. The arrangement of the parts of an automatic motor-operated single-phase induction regulator is illustrated in Fig. 194.

Polyphase induction regulators.—Poly-

phase induction regulators are similar to the single-phase regulator described above except that both the primary and secondary are wound with as many sets of coils as there are phases in the circuit. They are distributed throughout the circumference of the cores and resemble the winding of an induction motor. Fig. 195 illustrates a six-phase induction regulator operated by a motor.

Relays.—The automatic operation of induction regulators is accomplished by the use of motors which are controlled by relays. Considerable current is necessary in starting, stopping and reversing the controlling motor, and it has been found advisable, therefore, to use a separate voltage-regulating relay and an auxiliary relay controlling the motor circuit.

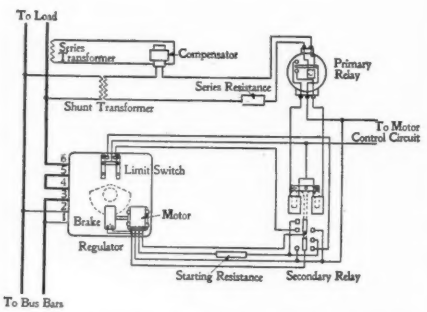


FIG. 196.—CONNECTION OF AUTOMATIC INDUCTION REGULATOR ON FEEDER CIRCUIT.

The former relay is in reality only a contact-making voltmeter, connected to the circuit to be regulated. When the voltage is too high, it closes one circuit of the auxiliary relay, and when too low, it closes another circuit. It is made delicate enough to maintain the voltage fluctuations within about one-and-one-half per cent, and yet is capable of adjustment to any normal voltage. The upper stationary contact is closed when the voltage is too high and the lower contact when it is too low. The voltage change required is regulated by screw adjustments of each contact.

The auxiliary relay is connected between the above relay and the motor circuit and relieves the voltage regulator from carrying the comparatively heavy current necessary to operate the motor. The auxiliary relay is in effect an electrically operated double-pole, double-throw switch with carbon contacts. The general connections of an induction regulator outfit with relays and motor are shown in Fig. 196.

SWITCHBOARD AUXILIARIES.

Potential compensators.—Where the receiving circuit is some distance from the generators difficulty is experienced in determining the potential difference at the receiving end, since the station voltmeter indicates the electromotive force of the generator or busbars. By means of a compensator, such as illustrated in Fig. 197, the voltmeter reading can be corrected both for inductive and non-inductive resistance in the circuit, so as to indicate the potential difference at the point of consumption without requiring pressure wires to be run to it. As shown, there are two adjustments, one for inductive drop and the other for non-inductive drop.

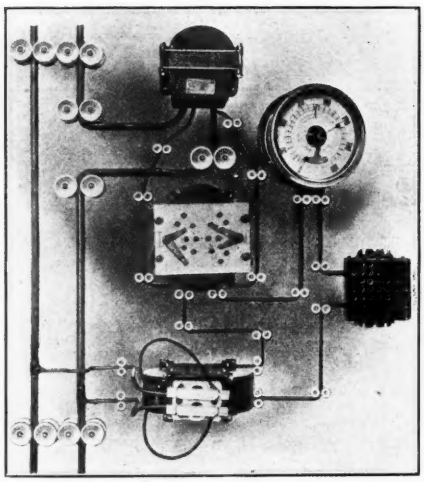


FIG. 197.—CONNECTIONS OF VOLTMETER COMPENSATOR.

When the compensator is properly set for the circuit in which it is placed it causes the voltmeter to indicate the voltage at

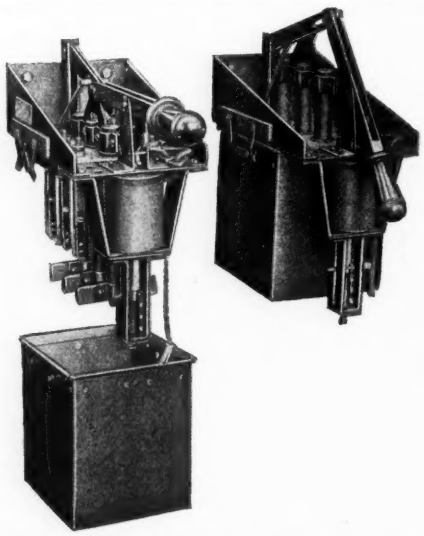


FIG. 199.—TRIPLE-POLE AUTOMATIC OIL-BREAK CIRCUIT-BREAKER.

the point of consumption for all currents and for all kinds of load.

Oil switches.—The use of oil in connection with switches and circuit-breakers has been of very great importance in the development of high-potential electrical transmission of power. The use of oil switches is now very general, as experience has shown them to be preferable to other types so far introduced for high-tension switchboards. Air-break switches for this service require magnetic blow-outs for disrupting the arc and they are very bulky. A simple form of two-pole oil switch is shown in Fig. 198 with the oil tank removed. When used for moderate currents and voltages oil switches are generally mounted directly back of the switchboard. For large currents and high voltages the oil switches are usually installed in separate cells and are then remote controlled, being most commonly motor operated.

Circuit-breakers.—The automatic switch or circuit-breaker is now a very popular type and frequently embodies a low-voltage release as well as an overload release.

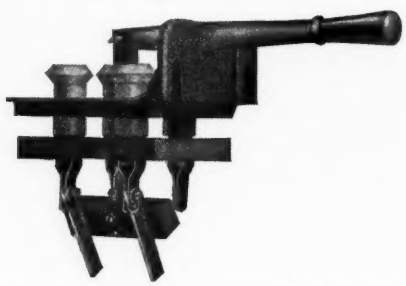


FIG. 198.—DOUBLE-POLE OIL SWITCH WITH CASE REMOVED.

The overload release is usually an arrangement of a coil in series with the circuit. In the coil is a plunger, which is actuated by a current heavier than normal so as to release a catch and open the switch. The plunger can be adjusted to operate at any predetermined point within wide limits. A triple-pole circuit-breaker of this type is shown in Fig. 199; its capacity is fifty amperes at 600 volts.

The low-voltage release is a similar device, with its trip coil connected across one phase, so as to throw the switch when the voltage drops below a predetermined point. For example, in the operation of motors, if the voltage falls below a certain amount considerable strain and possible damage would result to a large motor if it were still connected when the voltage went up to normal again.

Another type of electrically operated circuit-breaker is shown in Fig. 200. Circuit-breakers of this type are used for voltages up to 35,000 and for currents up to 2,000 amperes. The contacts are enclosed in oil-filled cylinders and are mounted in separate compartments, as shown.

Time-limit relays.—In many cases it is

not desirable to open a circuit immediately, for example, an overload of very short duration on an important feeder might not be harmful, and yet be decidedly dangerous if of a few seconds' duration. The bellows type of relay, a diagram of which is shown in Fig. 201, is designed to control an oil switch in this manner. The bellows is at the top and when the iron core of the solenoid is actuated by the coil it can move but slowly because of the slow escape of the air from the bellows. As the solenoid is drawn in the bellows moves upward and the operating-circuit terminals below it are closed.

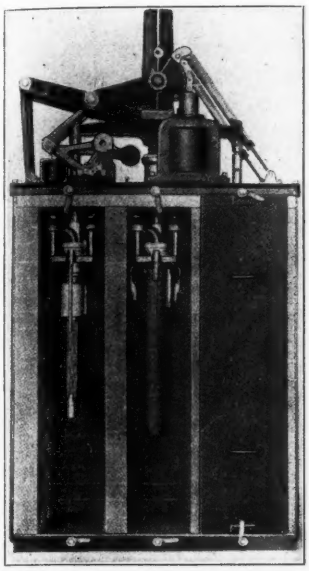


FIG. 200.—HIGH-TENSION OIL CIRCUIT-BREAKER, SHOWING OIL TANK AND CONTACTS.

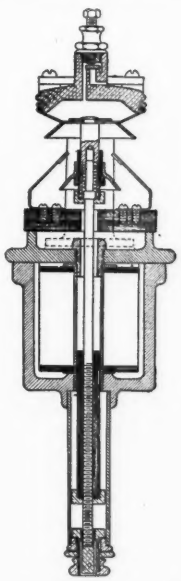


FIG. 201.—TIME-LIMIT OVER-LOAD RELAY.

The inverse time-limit relay is so arranged that the retarding action varies inversely with the current flowing, so that the greater the current the quicker the relay will respond. Relays are also made that open the switches when the line current, or one phase of it, reverses. The use of various kinds of relays permits the use of simple oil switches that may be opened at will or automatically under various abnormal conditions.

Switchboard design.—The design of a switchboard is a problem to be worked out for each installation. There are many items to consider and a wide range of selection as to instruments and methods of connection. Among the desirable features to be observed in laying out a switchboard are: Accessibility of all parts, fireproof construction, keeping live parts from the front of the board, simple and "foolproof" arrangement of circuits, provision of abundant protective devices, as well as indicating and recording instruments for proper operation of the units and for recording their output. Many of these points have been touched on already.

The multitudinous possible arrangements of circuits, switches and instruments in a switchboard is a subject very large in itself and beyond the scope of this series of articles, which have attempted to give only an outline of the general principles involved in the generation and utilization of the alternating-currents most commonly employed at the present time.

[THE END.]

Lights Controlled by Wireless.

The recent Omaha Electrical Show was lighted through wireless telegraphy during one evening, the first time that a large lighting current has been controlled without wires. The system is a discovery of Dr. Frederick Millener, wireless expert of the Union Pacific.

Four thousand incandescent electric lamps were controlled from a wireless telegraph station at Fort Omaha, five miles from the building. A dozen times during the evening Dr. Frederick Millener turned on and turned off every light in the big building from his station.

The current, as sent out from the Government wireless station at the fort, was picked up by the antennæ on the roof of the Electrical Building. From this it passed to a coherer, which in turn set the current to energizing a four-ohm track relay. This relay closed a circuit solenoid switch, thereby turning on a seventy-five horsepower current and the lights flashed on.

Electrification of Railways.

The question of the further electrification of the New Haven Railroad is receiving the earnest attention of the officials. The electrification of the New Haven from the Harlem River to Stamford, Conn., cost $5,000,000 in round figures, and the operation has been sufficiently successful to warrant an extension of the service.

It is now planned to increase the installation for passenger traffic from Stamford to New Haven, a distance of thirty-nine miles; also to increase the installation to provide for the electric operation of freight trains between New Haven and the Harlem River, as well as the electrical equipment of the branch running between New Rochelle and the Harlem River for both freight and passengers.

The total cost of such additional installation is placed by electrical engineers at about $12,000,000.

The question of the saving in operating costs of electricity, compared with steam, is still a debatable one, though the best estimates would indicate a saving in favor of electricity equal to between four per cent and five per cent on the total cost of installation of $17,000,000, this latter figure including the cost of the present installation between Harlem River and Stamford.

This saving alone might not justify such a large expenditure were there no other factors to be considered, such as increased business, ability to handle a larger business to better advantage and the general convenience of not only the traveling public, but the general public as well, by reason of the absence of dirt, smoke and excessive noise.

A Broad Charter.

Last week a charter to operate a neighborhood line was granted the Effingham Telegraph and Telephone Company of Effingham, Ga. Occasion was taken in the charter application to reserve the privilege of establishing a continental system of telephones. The incorporators ask that they not only be authorized to install a local system, but be given the right to extend it into all the towns, cities and counties of Georgia and into all the cities, towns and counties of all the other states or territories of the United States, including the District of Columbia. The capitalization is $5,000.

It is understood that the company does not intend doing a cable business, or "island possessions" would have been included in its field of possible operation.

FACTORS DETERMINING THE EFFICIENCY OF TROLLEY WIRE.[1]

BY CARL F. WOODS.

No department of electric railroading has received less attention than the transmission line, and particularly the trolley wire. In the construction and maintenance of an electric railroad no expense is spared to obtain power-station equipment of the highest efficiency while the trolley wire, which is just as essential for operation, is generally purchased with no restrictions on the quality of material.

The entire development of electric traction has taken place within the past twenty-five years, and this short period of time has witnessed an almost fabulous advance in the improvement of power stations and rolling stock. Higher voltages, greatly increased electrical output, heavier and more efficient cars capable of increased speeds have been noticeable on all lines. The increasing demands of traffic and the necessity of economical operation have forced the development of machinery of high efficiency. In spite of the great advance along all other lines, the trolley wire of today is not essentially different from that at first installed.

At the present time there are over 25,000 miles of electric lines in the United States. Calculating the value of the trolley wire in use at the current price and assuming the average weight per mile as 2,000 pounds, this shows a total investment of $8,000,000. This wire is the artery of the entire system and any injury to it cripples the operation of the road and decreases thereby the efficiency of the expensive generating equipment, and yet an examination of the records of roads operating many hundred miles of track shows that a broken trolley wire is almost a daily occurrence.

Numerous attempts have been made to specify the necessary characteristics of trolley wire, some of which have failed because of an incomplete understanding of the demands upon the material and many more on account of ignorance of the processes of manufacture and the defects inherent to these processes. The determination of the qualities necessary in an efficient material must always be preceded by a thorough understanding of the conditions which it must meet and by a careful study of the material itself and the limitations imposed by manufacturing processes.

The trolley wire in general use in the United States is made from hard drawn copper, the sizes and shape varying considerably, but circular wire having a diameter of 0.364 inches, which corresponds to No. 00 on the Brown & Sharpe gauge, is perhaps the most common form of construction. Ordinary soft copper does not have sufficient strength for this service, so that reliance has had to be placed upon either steel, bronze or hard-drawn copper. While steel wire has the requisite strength, it is subject to severe corrosion from the weather and has vastly greater electrical resistance. The silicon, phosphorus and other bronzes of a similar nature possess great strength, but all have the serious defect of much lessened conductivity. Soft copper wire has a strength of about 24,000 pounds per square inch, while hard-drawn wire can be made having a strength of as high as 67,000 pounds per square inch. Hard-drawn wire, although possessing some serious deefcts, has therefore been accepted as being much better than the other materials available for the purpose.

In standard construction, trolley wire is suspended in spans of 100 feet on straight lines and in shorter spans on curves, the distance depending upon the radius of the curve, local conditions, etc. These spans are supported by ears which vary in construction, but for the most part depend upon a fixed mechanical grip of the wire. In the earlier construction, ears were soldered to the wire, a process which annealed the hard-drawn copper with the consequent reduction in tensile strength, but this practice is now rapidly becoming obsolete. The wire, therefore, is subjected to the pull of its own weight, to the extraordinary stresses of ice and snow and to severe pounding from the trolley wheel. In addition the wheel passing along the wire gives to it a wave motion which proceeds along the wire until an ear or other fixed support is reached, where the wave is suddenly checked, with a consequent sharp upward bend, followed by a series of bending stresses diminishing in force as the wave motion dies out. On a busy line where cars are operated on a small headway the wire is subjected to practically a continuous effect of this nature, and in addition to this must be capable of carrying a large amount of power in order to diminish the outlay in feed wire.

To give efficient service under the conditions above noted, trolley wire must possess the following qualities: Conductivity, tensile strength, flexibility, homogeneity and toughness.

Each of these qualities is essential and no one of them can be increased beyond a certain point without a proportionate reduction of one or more of the others. For example, certain wires have been made from alloys of copper and tin which have high tensile strength, great toughness and homogeneity, but are lacking in flexibility and have a conductivity only half that of pure copper. On the other hand, by proper drawing, wire can be made very homogeneous, flexible and tough, but lacking in tensile strength, the conductivity being unimpaired. To recapitulate, high conductivity is necessary for economical operation; tensile strength to withstand the abnormal stresses; flexibility to enable stringing and to allow the wire to adjust itself under strains and blows; homogeneity that the stresses may be uniformly distributed along the wire and toughness to withstand kinking, wrenching and slow distortion without giving way.

Attention naturally turns next to the methods of determining to what extent wire possesses these essential properties. The determination of conductivity is very readily and accurately made with a Wheatstone bridge, or one of the several appliances based upon the same principle which are especially adapted for trolley wire. Tensile strength may be determined in a testing machine of suitable capacity, but owing to the nature of copper the elastic limit cannot be determined by a drop of the beam, as the metal apparently yields quite steadily up to the breaking point. Numerous conflicting figures are in print regarding the yield point of copper, but as a stress and strain diagram shows a nearly perfect curve, the actual elastic limit can only be accurately determined by applying increasing loads for a definite length of time and measuring the permanent set in each case. Such a procedure is obviously too complicated for commercial testing, so that the elasticity of the wire has to be judged by other means. Under ordinary circumstances, power to resist the effects of twisting is not necessary for conducting wire, but the torsional strength measures indirectly but accurately two of the most important mechanical properties that a wire can possess, namely, homogeneity and toughness. In a tensile-strength test the maximum tensile load is largely a factor of the cross-sectional area and the amount

[1] Abstract of a paper read before the Division of Industrial Chemists and Chemical Engineers of the American Chemical Society, December 31, 1908. The author is connected with the Arthur D. Little Laboratory, Boston, Mass.

of work which has been put into the hardening of the surface. This test will detect inferior drawing or inherent weakness of the copper, but it gives no idea of the power of the wire to resist distortion, nor of defects such as oxide seams which run lengthwise of the wire, and do not have a cross-sectional area of sufficient size to affect the breaking strength. Under a torsional strain, however, such defects are quickly noted. If the wire contains an oxide seam as above spoken of, the twisting will open it up and at once lessen the strength of the wire. If the wire is of unequal hardness the twists will tend to bunch up in the softest portion and very noticeably show this spot. Inferior copper not only shows a very low number of turns, but splinters and slivers of metal appear on the surface which in very bad wires fall off to such an extent that a paper held beneath the sample during torsion will show a considerable collection of copper fragments. Non-homogeneous copper, due either to impure metal or uneven drawing, will show a great difference in the number of turns which different specimens will stand without breaking, while high-grade metal which has been carefully drawn twists evenly and uniformly with no slivering, and shows little difference in the number of turns on different specimens. It is, therefore, desirable to make at least three torsion tests, whereas one tensile test is sufficient to obtain an accurate measure of the strength.

In the appended table No. 1 are given a series of tests which clearly illustrate the four general divisions into which the trolley wire of commerce may be divided by reason of difference in physical qualities. Specimens A, B, C, having tensile strengths of 5,500 pounds or higher and torsion tests averaging about thirteen, represent wire lacking toughness which has been given a high tensile strength by drawing. Specimens D, E, F, having tensile strengths around 5,300 pounds and torsion tests of about fifteen, are wires lacking both toughness and surface hardness. Specimens G, H, I, having tensile strengths of about 5,100, but torsion tests of approximately twenty-three, are typical of wires in which the torsion has been obtained at the expense of tensile strength, while specimens X, Y, Z, with tensile strengths over 5,400 pounds, together with torsion tests of twenty-six and even higher, represent the best trolley wire which can be made at a reasonable price.

TABLE NO. I.

Sample No.	Diameter, Inches.	Torsion Turns in 10".	Tensile Load, Lbs.	Conductivity, %.
A	0.365	14	5,650	98.4
		12		
		9		
		Av...12		
B	0.364	11	5,550	98.6
		12		
		11		
		Av....11		
C	0.362	18	5,500	98.2
		14		
		16		
		Av....16		
D	0.365	18	5,260	98.6
		16		
		18		
		Av....17		
E	0.365	14	5,270	98.7
		15		
		16		
		Av....15		
F	0.364	14	5,370	98.7
		13		
		14		
		Av....14		
G	0.364	21	5,070	98.9
		23		
		22		
		Av....22		
H	0.364	22	5,110	98.4
		25		
		21		
		Av....23		
I	0.365	24	5,210	98.4
		25		
		24		
		Av....24		
X	0.364	27	5,400	98.3
		30		
		28		
		Av....28		
Y	0.364	25	5,490	98.4
		27		
		26		
		Av....26		
Z	0.364	25	5,590	98.2
		28		
		25		
		Av....26		

Of these four classes there is again a distinction in that the first two represent copper of an inferior grade which cannot be made the equal of the wires of the last two classes by any treatment in the rod mill. On the other hand, wires of the last two classes are both made from excellent copper, although specimens X, Y, Z, are wires greatly superior in all respects to the preceding three. It is interesting to note that all of these wires have practically the same conductivity, which shows clearly the fallacy of attempting to value trolley wire by conductivity and tensile strength alone as is so frequently done.

It is therefore necessary not only to obtain high-grade copper, but also to secure the proper balance between tensile strength and torsion, as these two properties are correlated and an increase in one, beyond a certain point, results in a proportionate decrease of the other.

The preceding remarks have shown the conditions under which wire must work and the qualities which are necessary to successfully meet these conditions. Attention must now be turned to the process of manufacture to determine how these qualities may be obtained and what defects of such processes injure the finished wire. For this purpose a brief review of the industry is necessary.

In the refining furnace the copper, which is already at least ninety-six per cent pure from the blister furnace, is oxidized by air until a large part of the impurities have been removed and copper oxide is formed in considerable excess. Cuprous oxide is readily soluble in molten copper and acts as a powerful oxidizing agent by giving up its oxygen to any metallic bases present, so that an excess of oxide insures the presence of all metallic impurities in the oxide form. The excess cuprous oxide is then removed by burying a piece of green wood in the molten mass and covering the surface with charcoal. This process must be stopped within very narrow limits, as over-reduction will throw the impurities back into the metallic state.

The influence of cuprous oxide has been studied by Mr. Patch of the Detroit Copper Company, Dr. Edward D. Peters, Jr., who is without doubt one of the best authorities on the metal in this country, and by the well-known German authority, W. Hampe, among many others. Many of the impurities in copper have been found to be much more injurious when present in the metallic state than when in the form of oxides, and one effect of the cuprous oxide, as above mentioned, is to convert these impurities into the comparatively inert and harmless form and so improve the quality of the metal. In large quantities, however, it is known to harden copper while at the same time causing it to become short or brittle, and according to Hampe the presence of one per cent produces a diminution in toughness.

It is therefore possible to treat low-grade metal so that it will have high conductivity, although the large amount of cuprous oxide present greatly reduces the toughness. In purchasing copper for drawing trolley wire the manufacturer insists upon conductivity, but as a rule cares little for the other physical qualities, as he can obtain sufficient tensile strength by drawing. Lake copper possesses both high conductivity and excellent mechanical qualities, but this kind of copper costs from one-eighth to three-quarter cent per pound more than electrolytic. Why the latter should be inferior to Lake is difficult to explain, but experience shows that the general run of commercial electrolytic copper is by no means uniform in physical qualities, and as a general thing is distinctly inferior

to Lake for wire-drawing purposes. The cheaper price of electrolytic results in its use by many manufacturers, although they frequently understand that the wire will be inferior.

The refined copper comes to the rod mill in bars weighing about 200 pounds each, approximately ten of which are used in the manufacture of a mile of wire. These bars frequently have ridges along the sides, due to faults in casting, and the surface is often covered with a layer of oxide. These bars are heated in a furnace until sufficiently soft for rolling and are passed through a series of rolls diminishing in size until a rod of the proper diameter is obtained. The rod is then cooled and drawn through dies, the rods being connected by brazing. The dies give the wire a dense, hard exterior coating which increases its tenacity. As the strength obtainable is almost a direct factor of the work expended upon the wire, the smaller the size the greater the tensile strength per square inch, so that the strength of the trolley wire is readily varied by changing the size of the rod and the number of dies.

One of the most serious defects occurring to wire at this point is from ridged bars, as described above. Ordinarily the bar will not be sufficiently heated to dissolve the copper oxide on the surface, so that as the softened bar enters the first passes of the rolls the ridges are lapped over, enclosing the oxide scale. The subsequent passes and the drawing through the dies obscure this flow almost entirely, but it remains a serious menace to the toughness and the resistance to wear of the copper, as has been previously shown in remarks on the torsion test.

A second cause of trouble arises at the same point by overheating the copper in the furnace, in which case copper oxide is formed on the surface and quickly dissolves through the entire bar, thereby increasing the oxide content and tending toward the production of brittleness. Both of these dangers can be avoided by careful selection of the bars and by proper regulation of the temperature of the softening furnace.

As the production of the hard surface from drawing is at best a rather delicate operation, careless handling, uneven welding of the rods and unequal temperature of the wire while passing through the dies will all produce noticeable defects in the quality of the finished wire, so that care throughout the mill is absolutely necessary for the best results.

It appears therefore that the most efficient wire must possess not only high conductivity, but the maximum torsion and tensile strength possible in commercial copper, and that to obtain this it is necessary, first, to use high-grade copper and to prevent an excess of cuprous oxide entering it at any stage of the manufacture, and secondly, to select as perfect bars as possible and to observe extreme care in every treatment through which they pass. The question at once arises, can such wire be purchased at a commercial price? The writer must admit that this high-grade wire cannot be obtained at the ordinary market price, but requires the payment of a premium of one-half cent per pound. To produce wire of this grade consistently the wire manufacturer must use the higher-priced Lake copper and observe unusual care in its treatment so that he is justified in demanding a higher price. Experience in the use of this wire has shown conclusively that it is well worth the additional cost.

The appended table No. 2 gives the results obtained upon thirteen consecutive miles of trolley wire made from selected bars of Lake copper. The tests were made upon each mile of the wire and the results show the great uniformity obtainable with proper care. It should be said in this connection that this wire was not made as an experiment, but was drawn by a certain wire company as a part of a regular business contract.

The point must be kept clearly in mind, however, that even the best of wire is of little value if improperly used, and the consumer must realize that the same degree of care which he insists upon from the manufacturer is essential in the handling and stringing of the finished wire.

The study of copper wire and the demands made upon it show the great need of a more thorough knowledge of this material. Owing to the minute quantity of impurities which exert a marked effect upon the qualities of copper, a chemical analysis is too difficult for technical purposes. The iron and steel industry is largely controlled today by microchemistry, and, in the same way, there is a future for this same practice in the copper industry. Of first importance is the careful working out of the copper-cuprous oxide system with the determination of the number of phases occurring and the physical properties incident to different alloys. Doubtless much of this information is already in the hands of the copper refiners, but it remains for chemical engineers and chemists interested in industrial materials to verify and complete the work for the consumer. This should afford a good field for experiment stations and research students generally.

TABLE NO. II.

Sample No.	Diameter, Inches.		Torsion Turns in 10".	Tensile Load, Lbs.	Conductivity, %.
1	0.363		22½ 24¾ 22½	5,470	99
		Av....	23½		
2	0.364		23 25 23	5,490	98.7
		Av....	23½		
3	0.363		19¾ 25½ 17½	5,400	97.8
		Av....	21½		
4	0.363		23½ 25½ 23½	5,470	98.8
		Av....	24		
5	0.363		22½ 21¾ 24	5,450	97.8
		Av....	22¾		
6	0.363		24 20 24¼	5,500	98.6
		Av....	22¾		
7	0.363		22½ 24 23¾	5,420	97.8
		Av....	23½		
8	0.365		23 24 20	5,510	98.5
		Av....	22		
9	0.363		24 19½ 23½	5,540	98
		Av....	22		
10	0.363		21 23 21	5,470	98.8
		Av....	21½		
11	0.363		22 22½ 23	5,490	98.8
		Av....	22½		
12	0.363		26½ 26½ 23½	5,500	98.5
		Av....	25½		
13	0.363		23 20½ 24	5,450	98.7
		Av....	22½		

Cable Open to Venezuela.

The Venezuelan Government and the French Cable Company signed an agreement on May 12 in settlement of all outstanding difficulties and the cable was opened for business.

The French Cable Company announced on May 11 that direct cable communication had been restored with all points in Venezuela. This terminates the cable isolation of Venezuela, during which time communication with the outside world has been carried on by mail and messengers to neighboring islands, and at times by wireless to Curacao.

The United States & Hayti Telegraph Company announces that the rate to Venezuela has been reduced to $1 per word from New York, a reduction of fifty cents from the rate charged at the time the cables were cut off by Castro's government in January, 1906.

QUESTIONS AND ANSWERS.

USE OF IRON CONDUIT FOR ALTERNATING-CURRENT LEADS.—In running some conduit for a ten-horsepower induction-motor circuit I was told to put both the leads in the same conduit, as alternating-current circuits are always run in this way. Why is this? Does not running the leads in separate conduit, as for a direct-current motor, give better insulation?—M. R., Minneapolis, Minn.

Unquestionably the use of separate conduit for each lead gives more perfect insulation and better safeguard against short-circuits. However, any conductor, even though straight, is surrounded by a magnetic field whose lines of force form circles about the conductor. If the current in the conductor is a direct current, this magnetic field varies only with the fluctuations of the current and therefore consumes practically no energy. With an alternating current in the conductor, the magnetic field surrounding it is continually reversed in direction, which results in the setting up of eddy currents when iron conduit is used. These currents, as well as the hysteresis due to the reversed magnetization, cause the conduit to become heated and represent a certain energy loss in the leads, much greater than that entailed in overcoming their resistance. Moreover, the increased inductance of the leads means a greater angle of lag and therefore lower power-factor. With short leads and moderate currents these troublesome features are not so marked, but with increasing length and greater currents they become of rapidly increasing magnitude. By running both leads in the same pipe the magnetic effect is completely neutralized. For this reason duplex or "twin" wire is extensively used for alternating-current conduit work, the reduced cost of the conduit counterbalancing the increased cost of the wire.

ELECTRICALLY OPERATED VALVE.—Kindly tell me how I can operate electrically a large valve on a water main. I would like to control it at a reservoir or standpipe some three-fourths of a mile from the pumping station. This is to be used in case of fire to get direct pressure on the mains. We have an alternating-current system in this town.—N. I. S., Norman, Okla.

Electrical operation of this particular valve can be carried out very conveniently. An electric motor is geared to the valve stem and its circuit is run to the switchboard or operating gallery of the pumping station, where the motor controller is installed. The controller may be quite simple, as it needs only to start the motor in either direction to open or close the valve. Alongside the controller a circuit-breaker should be placed so that when the motor has fully opened the valve further rotation on its part establishes a large overload and opens the circuit-breaker. This avoids the use of a limit switch and permits the motor to be of the simplest kind. A squirrel-cage induction motor is particularly suitable for this case. It has no sliding electrical contacts and can be entirely enclosed in a waterproof case. Good insulation of the windings is essential, as the motor is likely to be exposed to considerable dampness. The larger valve manufacturers make a specialty of electrically operated valves. In ordering the valve full details should be given of its size and type and approximate pressure in the main; also the voltage and frequency of the electric supply circuit available.

WIRELESS TELEGRAPHY.—Please describe the construction of the magnetic and electrolytic wave detectors used in wireless telegraphy; also what is understood by the terms capacity and inductance as applied to the wireless telegraph. What size condensers should be applied to a six-inch spark coil to give the best results in wireless work?—A. S., Seattle, Wash.

A form of magnetic detector extensively used by Marconi consists of a small transformer with a primary having a single layer of wire wound on a glass tube and a secondary of finer wire to which is connected a telephone receiver. One side of the primary coil is connected to the aerial and the other side to ground. An endless loop of fine wires is moved over two grooved wheels driven by a spring motor; these wires pass through the glass tube and constitute a movable core for the transformer. Alongside the primary coil are mounted two strong permanent horseshoe magnets. Oscillations affecting the primary set up corresponding currents in the secondary, and therefore in the telephone receiver. The De Forest electrolytic detector consists of an insulating tube of glass or ebonite in which are adjustably mounted two electrodes about one-eighth inch in diameter and separated by one-sixteenth inch. About them is a mixture of rather coarse filings and oxide of lead in equal bulk and converted into a paste by the addition of glycerine or vaseline with a slight amount of water or alcohol. The meaning of capacity and inductance in wireless-telegraph work is the same as in any other electrical field. Thus the capacity of an oscillating circuit, as of any circuit, is the quantity of electricity required to raise its potential to unit value, or $C = \frac{Q}{E}$. The capacity depends on the length and area of the oscillator, as well as its nearness to the earth and other conducting bodies. Inductance is the electromagnetic inertia of a circuit; strictly defined, it is the ratio between the electromagnetic energy of the circuit and one-half the square of the current; or, since $W = \frac{1}{2} I^2 L$, the inductance $L = \frac{W}{\frac{1}{2}I^2} = \frac{2W}{I^2}$. The inductance of an oscillating circuit depends chiefly upon its form, whether straight or coiled, and on the presence or absence of iron adjacent to it. The capacity requisite for an induction coil depends upon the design and proportions of the coil. No fixed rule can be laid down for it. For a good coil the condenser capacity is usually adjustable by varying the number of sheets in service to give the best results. A two-microfarad condenser with the adjustable feature referred to, should suffice for the six-inch coil.

TUNGSTEN LAMPS FOR SIGN LIGHTING.—While visiting the Omaha Electrical Show on the opening day I heard some advocacy of the use of low-voltage tungsten lamps in connection with a special transformer for lighting up signs. I can see that it is desirable to use tungsten lamps for long-hour service, such as sign lighting, but I should think that the added expense of a transformer would more than counterbalance the saving from the tungsten lamps.—J. B., Council Bluffs, Iowa.

To get the best results in sign lighting it is desirable to use small candlepower lamps, as in this way the letters and design in general can be better outlined. For this reason four-candlepower lamps are generally used, and even two-candlepower lamps have been utilized to some extent. The manufacture of a tungsten lamp of very low candlepower for normal lighting voltage (110 volts) is impossible on account of the extreme fineness of the filament that would be required. Recently low-voltage tungsten lamps of various sizes from the miniature up have been perfected and found to give excellent service. On account of their fairly thick and short filaments these lamps stand harder usage and have a longer life than those for standard voltage. By using a special transformer, stepping down from 110 to, say, ten volts, that can be mounted directly on the sign the use of these low-voltage tungstens is made

possible. It has been actually found that the initial expense of this transformer, which is not very great, added to the increased initial cost of the tungsten lamps compared with carbon lamps, still leaves a good margin in favor of the tungstens when account is taken of the reduced current consumption. The transformer in this class of service is switched off the circuit when the sign is not lighted by placing a switch in the primary circuit or by placing it on a special sign circuit controlled from the central station. In this way the core loss on no-load is eliminated. The advantage of using a transformer for these low-voltage lamps instead of placing a group of ten or so in series across the 110-volt circuit is that it permits any number of lamps to be used and avoids the extinguishing of a row of lights when any one of them burns out.

SPECIFIC GRAVITY OF STORAGE-BATTERY ELECTROLYTE.—In receiving directions on the care of my storage battery I find the statement that the electrolyte should have a specific gravity of 1275 when the battery is fully charged. The hydrometer shows this reading, but what does it mean? I thought water was taken as the unit for specific gravity.—R. V. B., Superior, Wis.

It has become customary among storage-battery manufacturers to give the specific gravity in four figures and to discard the decimal point. The actual specific gravity of 1275 electrolyte is 1.275, that is, 27.5 per cent heavier than water, the specific gravity of which is taken as 1.000.

Mayor McClellan Approves Subway Bill.

Mayor McClellan, of New York city, approved on May 13 the Travis-Robinson bill, which authorizes the Public Service Commission and the Board of Estimate to issue franchises for the construction of subways by private capital. The city is allowed to purchase, after ten years, the subways built under the bill at a cost of the original construction price plus fifteen per cent.

The bill also includes a clause which classifies the New York subways as local improvements, the purchase price to the city being assessed in proportion to the property benefited by them. The assessments are payable in ten yearly installments.

The mayor also signed the bill permitting the extension of the subway in the Bronx through Westchester to Pelham Bay Park.

Government Examination for Wireless Experts.

The United States Civil Service Commission announces an examination on June 9, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of electrical expert (wireless telegraphy) in the Bureau of Equipment, Navy Department, at a salary of $3,000 per annum, and vacancies requiring similar qualifications as they may occur.

The examination will consist of the subjects mentioned below, weighted as indicated:

Subjects.	*Weights.*
1. General and technical educational training	10
2. Technical experience	20
3. Special experience in wireless telegraphy and telephony	40
4. Original research and experiments in electrical science with special application to wireless telegraphy and telephony	30
Total	100

Competitors who fail to receive a rating of at least 70 per cent in the third subject will not be eligible for appointment.

Age limit, twenty-one years or over on the date of the examination.

This examination is open to all citizens of the United States who comply with the requirements.

This announcement contains all information which is communicated to applicants regarding the scope of the examination, the vacancy or vacancies to be filled and the qualifications required.

Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application Form 304 and special form. No application will be accepted unless properly executed and filed, with the material required, with the Commission at Washington prior to the hour of closing business on June 9, 1909. In applying for this examination the exact title used in the application should be "Electrical Expert (Wireless Telegraphy and Telephony)."

To File List of Shareholders.

Holding companies of securities in railroad, street-railway, gas and electric companies are compelled in a bill now before the Massachusetts Senate to file with the state a copy of the declaration of trust, list of shares owned and stockholders. The list of shares owned and stockholders must be filed on or before May 1, each year.

Aero Club and the Wrights.

A hundred or so members of the Aero Club of America entertained the famous Wright brothers at a luncheon at the Lawyers' Club, New York, last week. There were also present members of the Automobile Club, the Aeronautic Society, the Ohio Society, and other organizations gathered to honor the aviators, and there was considerable curiosity as to how they would surmount the ordeal of public speaking. But after it was all over the sentiment was concisely expressed by a shout, "What's the matter with the Wrights?" "They're all right," was the reply from one hundred throats.

Notwithstanding the statement of Wilbur Wright that he had no complaint to make of their treatment in America, the failure of the United States Government to make it possible for them to continue their experiments here was frequently referred to, and by none more forcibly than by Police Commissioner Bingham, who sat at one of the guests' tables and was the only official representative of the city present, Mayor McClellan being obliged to send a letter of regret. General Bingham struck the keynote of the reception at once by saying:

"We are glad to meet the Wrights because they are men who have done something. They belong to a class we all love and admire. As an army officer, I feel a sense of mortification and chagrin that the Wrights were compelled to go abroad to get that recognition from foreign lands that should have been theirs here. Our Government is so ultra-conservative that it is afraid to take a chance. It is a shame that it should be so."

L. D. Dozier, president of the Aero Club of St. Louis, told of the invitation he had extended to the Wrights to visit St. Louis in October at its municipal centennial celebration.

On June 10 the gold medals awarded by the Aero Club will be presented to Wilbur and Orville Wright by President Taft in the White House.

The Wright Flying Machine Company, Limited, has been organized in Berlin with a capital of $125,000. It will construct and operate aeroplanes on the Wright system.

Trolley Freight Bill Signed.

Governor Stuart, of Pennsylvania, has signed the bills passed by the Legislature providing for night freight service on trolley lines and in the subway in Philadelphia, and authorizing the transportation of all kinds of freight.

The Tariff on Electric-Light Carbons.

To THE EDITORS.

A new joker added to the old joker on the method of imposing the duty on electric-light carbons you have written and explained already in your valued paper.

The first joker was by reducing the duty on electric-light carbons from ninety cents to seventy cents, but instead of making it on carbons they made it per 100 feet, thereby actually raising the duty, inasmuch, as you know, on the old rate which did not specify the length, we could import the carbon in double lengths and cut them in two, of course reducing the duty.

Now the latest is that Senator Smoot, acting for the finance committee, is proposing a change of thirty-five cents per 100 feet on carbons made of petroleum coke, and sixty-five cents per 100 feet on all other carbons for electric-lighting purposes.

This at first sight looks like a material reduction, but in fact it is only a reduction of five cents per 100 feet, because carbons made of petroleum coke are neither manufactured in Europe nor imported; in other words, a substantial reduction of duty is proposed on an article not imported, while the article which is imported is, even with sixty-five cents per 100 feet duty, just as much excluded from importation as it would be at seventy cents per 100 feet.

I think to bring this new joker to the knowledge of the consumers through your valuable paper will no doubt impress the tariff makers in Washington and encourage such Senators as have the interest of the consumers of the United States at heart.

HUGO REISINGER.

New York, May 14.

Side Doors for Subway Trains.

The New York Public Service Commission has ordered the Interborough Rapid Transit Company, New York city, to convert fifty cars into end-side door or center-side door cars as they choose, by August 15, and thereafter to equip two eight-car trains per month and to continue the reconstruction of the equipment at this rate until the entire express trains are so equipped. The company is also ordered to increase its equipment by the purchase of new cars of the same style of side doors prior to October 15, 1909, so that by that time it will have sufficient cars to maintain a one minute, thirty-two seconds headway on express service during rush hours.

Chicago Electric Club.

At the regular weekly noonday meeting of the Chicago Electric Club, held on May 12, in the grill room of the Chicago Automobile Club, John Lee Mahin, of the Mahin Advertising Company, spoke on "The Advertising That Pays." He showed the relation of advertising to the salesman and to the general sales campaign and gave many excellent suggestions by which advertising can be made of great value to the particular house for which it appears. He stated frankly that only the advertising that pays in the end is worth using at all. Mr. Mahin pointed out that advertising should not attempt to do the work that the salesman does very much better personally, but, on the other hand, that it should be used extensively to do the work that the salesman's time is too valuable to do. As a criterion of the value of any advertisement in general, he laid down the ten following tests:

1. Is the advertisement the natural expression of the house that advertises?
2. Is it specific?
3. Is the advertisement timely?
4. Is it pertinent?
5. Is it consistent?
6. Is it persistent?
7. Does it partake of an authoritative tone?
8. Is it institutional?
9. Is it plausible?
10. Is it sincere?

At the conclusion of Mr. Mahin's remarks, Frank L. Perry was called on and made a short and very appropriate address on the points that had been brought out. Homer E. Niesz asked what should be the relation between the appropriation for advertising and that for the general soliciting campaign. Mr. Mahin stated that no general rule could be laid down, as it varied in practically every particular line. In some cases the expense requisite for proper advertising amounts to an extremely large percentage of the cost of the goods sold. In other cases it is but a very small percentage.

Tests of Meters in New York City.

The report of the New York Public Service Commission for April shows that there were 31,155 gas and 136 electric meters tested in all.

Of the meters tested on complaint, 29.2 per cent were two per cent or more fast, 13.8 per cent were two per cent or more slow, and fifty-seven per cent were between these limits and are therefore adjudged to be correct.

Steam Engineer Examinations.

The United States Civil Service Commission announces an examination on June 16, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of second-class engineer, $900 per annum, in the Custodian Service at Macon, Ga., and vacancies requiring similar qualifications as they may occur throughout the United States.

The examination will consist of the subjects mentioned below, weighted as indicated:

Subjects.	*Weights.*
1. Letter-writing (a letter of not less than 150 words on some subject of general interest. Competitors may select either of two subjects given)	10
2. Practical questions in mechanical and electrical engineering (comprising the construction and operation of the heating plant and electric-lighting and elevator machinery in first-class public buildings)	65
3. Experience in mechanical and electrical engineering work	25
Total	100

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners, at points in the various states designated by the Commission where examinations will be held, for appilcation Form 1052. No application will be accepted unless properly executed and filed with the Commission at Washington. In applying for this examination the title "second-class (or assistant) steam engineer, Custodian Service," must be mentioned at the head of the application.

Tri-Borough Company Applies for Bridge Franchise.

The Tri-Borough Railroad Company, recently incorporated at Albany, N. Y., has applied to the New York City Board of Estimate for a franchise for a surface line to operate from Flatbush Avenue, Broklyn, via two of the tracks on the new Manhattan bridge, to the intersection of Canal Street with Walker and Baxter streets, Manhattan.

The company does not stipulate for an exclusive franchise, but is willing to allow other companies to use its tracks, and offers to carry passengers for a five-cent fare, issuing eight tickets for twenty-five cents, pending the extension of its line either in Manhattan or Brooklyn. A public hearing is to be held on the matter on June 11.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

UNITED STATES TELEPHONE.

The report of the United States Telephone Company for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Gross	$444,849	$435,013
Expenses	212,877	193,212
Net	$232,972	$241,801
Other income	27,683	34,965
Total income	$260,655	$276,766
Bond interest	107,800	107,800
Surplus	$152,855	$168,966
Preferred dividend	51,855	51,150
Common dividend	.....	69,750
Balance surplus	$101,000	$ 48,066

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The Birmingham Railway, Light and Power Company reports a comparison of earnings for the month of March and three months ended March 31, 1909, as follows:

Month March:

	1909.	1908.
March gross	$181,818	$177,003
Operating expenses and taxes	114,203	112,686
March net	$ 67,614	$ 64,317
Interest charges	43,745	41,821
Sinking fund	1,041	1,041
Total interest and sinking fund	$ 44,787	$ 42,863
March surplus	22,826	21,453
Three months:		
Three months gross	551,615	522,090
Operating expenses and taxes	342,286	348,337
Three months net	$209,328	$173,753
Interest charges	131,231	127,042
Sinking fund	3,125	3,125
Total interest and sinking fund	$134,356	$130,167
Three months surplus	74,971	43,585

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of March and three months ended March 31, compares as follows:

	1909.	1908.
March gross	$213,766	$201,129
Expenses	118,715	114,880
March net	$ 95,051	$ 86,249
Other income	1,071	1,058
Total income	$ 96,122	$ 87,307
Charges	63,457	68,899
March surplus	$ 32,665	$ 18,408
Three months gross	653,075	625,968
Expenses	366,664	356,270
Three months net	$286,411	$269,698
Other income	1,262	2,656
Total income	$287,673	$272,354
Charges	205,381	205,953
Three months surplus	$ 82,292	$ 66,401

DETROIT UNITED RAILWAY COMPANY.

The report of the Detroit United for the month of March and three months ended March 31 compares as follows:

	1909.	1908.
March gross	$ 589,287	$ 529,236
Expenses	360,742	338,294
March net	$ 228,545	$ 190,942
Other income	11,987	4,552
Total income	$ 240,532	$ 195,494
*Charges and taxes	152,090	134,714
March surplus	$ 88,442	$ 60,780
Three months gross	1,668,041	1,503,827
Expenses	1,064,150	1,009,813
Three months net	$ 603,891	$ 494,014
Other income	34,555	14,481
Total income	$ 638,446	$ 508,495
*Charges and taxes	460,249	405,883
Three months surplus	$ 78,197	$ 102,612

*Taxes in 1908 are included in operating expenses.

INTERBOROUGH'S TRAFFIC.

In the month of March last, the Interborough carried a total of 43,994,740 passengers, which is 4,133,161 more than it had in March, 1908. Travel was divided as follows:

	March, 1909.	March, 1908.
Elevated lines	24,073,561	23,335,694
Subway	19,921,179	16,525,885
Total	43,994,740	39,861,579

It will be seen that while the elevated lines are still carrying more than half of the daily passengers on the system, the increasing popularity of the subway is causing that branch to overhaul the elevated. Where a year ago fifty-nine per cent of the travel was over the latter-named lines, and forty-one per cent in the subway, the figures in March were fifty-four per cent and forty-six per cent, respectively. On a daily average, Sundays included, the elevated carried about 777,000 passengers in March of this year to 643,000 carried by the subway. The number carried Sundays is but little more than half the week-day average.

April 12, 1909, was the biggest day in the subway's history, when, in connection with the crowds which attended the Petrosino funeral, there were carried 893,000 passengers in that single day.

KNOXVILLE RAILWAY AND LIGHT.

The Knoxville Railway and Light Company has issued a comparison of earnings for the month of March and three months ended March 31, 1909, as follows:

	1909.	1908.
March gross	$47,130	$46,521
Operating expenses and taxes	24,158	23,251
March net	$22,972	$23,270
Interest charges	11,483	11,623
Balance	$11,488	$11,647
March surplus	11,488	11,647
Three months gross	139,215	128,017
Operating expenses and taxes	71,428	73,345
Three months net	$67,787	$54,671
Interest charges	34,449	34,468
Balance	$33,337	$20,202
Three months surplus	$33,337	$20,202

WASHINGTON WATER POWER COMPANY.

The Washington Water Power Company, of Spokane, Wash., reports for the year ended December 31, 1908, compared as follows:

	1908.	1907.
Gross	$2,437,406	$2,094,282
Sundry receipts	17,179	2,103
Total receipts	$2,454,585	$2,096,385
Expenses and taxes	1,343,232	1,262,610
Net	$1,111,353	$ 833,775
Interest, depreciation, etc.	530,923	360,664
Surplus	$ 580,430	$ 473,111
Dividends	351,141	321,209
Net surplus	$ 229,289	$ 151,902
Previous surplus	644,861	492,959
Total surplus	$ 874,150	$ 644,861

HONOLULU RAPID TRANSIT AND LAND.

The Honolulu Rapid Transit and Land Company reports for the year ended December 31, 1908, compared as follows:

	1908.	1907.
Gross	$382,130	$367,134
Expenses	211,976	201,228
Net	$170,154	$165,906
Other income	7,797	7,475
Total income	$177,951	$173,381
Charges, taxes, depreciation, etc.	95,458	100,968
Surplus	$ 82,493	$ 72,413
Dividends	53,000	45,000
Net surplus	$ 29,493	$ 27,413

NEW YORK TRACTION LINES.

The New York Public Service Commission has made public the income accounts of the street-railway companies operating in Greater New York, for the quarter ended September 30, 1908. The statements of the Hudson & Manhattan Railroad Company, the Interborough Rapid Transit Company and the Brooklyn Rapid Transit system for the three months ended September 30, 1908, follow:

	Hudson and Manhattan.	Interboro Rapid Trans.	Brooklyn Rapid Trans.	Total all N. Y. Rys.
Gross	$121,373	$5,328,887	$5,117,661	$17,425,174
Operating expenses	127,898	2,675,709	3,085,552	11,801,050
Net	*$ 6,525	$2,653,178	$2,032,109	$ 5,624,124
Other income	142,419	337,175	138,210	896,628
Total income	$135,894	$2,990,353	$2,170,319	$ 6,520,752
Charges, taxes, etc.	833	2,899,163	1,552,231	6,670,510
Surplus	$135,061	$ 91,190	$ 618,088	*$ 149,758

*Deficit.

NORFOLK & PORTSMOUTH TRACTION.

The Norfolk & Portsmouth Traction Company reports for the year ended December 31, 1908. The income account, including allied companies, compares as follows:

	1908.	1907.
Gross	$1,877,930	$2,616,458
Expenses	1,104,346	1,655,654
Net	$ 773,584	$ 960,804
Additional deductions	.....	2,283
Net income	$ 773,584	$ 958,521
Charges, taxes, etc	790,630	704,808
Deficit	$ 17,046	*$ 253,712
Extra expenses	.....	126,508
Deficit	$ 17,046	*$ 127,204

*Surplus.

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week ended April 24, and sixteen weeks ended April 24, 1909, compared as follows:

Company.	1909.	1908.
Bakerloo	£ 3,310	£ 3,435
Piccadilly	5,665	5,660

Hampstead	3,845	3,665
District	9,732	8,762
Tramways	5,307	6,952
Total	£ 28,359	£ 28,434
Total, sixteen weeks	446,048	415,525

BOSTON ELEVATED.

Net earnings of the Boston Elevated Railway Company were materially helped out this last winter and spring by the very small snow expense, the smallest in the last five years, and one of the smallest in the entire history of the company.

The amount expended during the winter and spring of 1908-9 was but $26,000, compared with $190,104 in 1905 and $116,407 as recently as 1907. The amount required for this purpose in 1908 was but $36,473.

PHILADELPHIA COMPANY.

The annual report of the Philadelphia Company, including the affiliated concerns, except the Allegheny Heating Company, shows gross receipts of $16,554,593. The year before receipts were $18,767,441. Expenditures for improvements during the year were $555,353, as against $1,697,328 in 1908.

Comparing surplus, the present is $153,401 less than in 1908. The general balance sheet shows that the company owns stocks amounting to $45,112,929. Total assets have increased to $67,634,039, as compared with assets of $65,296,639 in 1908. The Philadelphia Company controls and operates about forty companies devoted to gas and electric lighting, fuel supply and street-car transportation. It has gradually extended its operations beyond Pittsburg and Allegheny, and many manufacturing towns at a distance depend on the company for light, heat and power.

The company holds under lease 433,538 acres of gas and oil territory. It has pipe lines of a combined length of 2,197 miles.

During the past fiscal year there was paid out in dividends $2,300,000. The company earned five per cent on its preferred stock and 8.2 per cent on the common.

UNITED RAILWAYS OF ST. LOUIS.

The Mississippi Valley Trust Company and Francis Brother & Company of St. Louis, and McCoy & Company of Chicago have purchased $1,500,000 general first-mortgage four per cent gold bonds of the United Railways Company of St. Louis, and are offering them for sale at eighty-six and interest, yielding about five per cent. They are dated July 1, 1889, and are due July 1, 1934.

These bonds are part of an issue of $42,000,000, of which there are outstanding about $30,000,000, while about $11,000,000 are reserved in the treasury to retire prior liens. They are secured by a first mortgage on about one-half of the properties of the United Railways Company in St. Louis and St. Louis County, with the exception of the St. Louis & Suburban Railway property.

THIRD AVENUE RAILROAD.

Receiver Frederick W. Whitridge, of the Third Avenue Railroad, New York city, has sent to the Public Service Commission his quarterly report, covering the Third Avenue Road proper, the Union Railway, the Forty-second Street, Manhattanville & St. Nicholas Avenue, and the Dry Dock, East Broadway & Battery Companies. They show in total gross earnings of $1,344,177 for the quarter, operating expenses of $1,093,738, leaving net earnings of $250,430, which, with other income of $166,850, makes a total income of $417,289. There are deductions of $234,894 for interest and other charges outside of operating accounts, leaving a surplus for the quarter of $182,395.

The interest paid, of course, does not include five per cent on $5,000,000 first-mortgage bonds on the Third Avenue and four per cent on $36,000,000 general mortgage bonds, which were defaulted in 1907 and are under foreclosure. The quarter's requirements on these two mortgages would be about $420,000.

Mr. Whitridge paid at the controller's office the $52,000 consideration fixed by the Public Service Commission for the franchise desired for an extension of the Union Railway on Pelham Avenue in the Bronx.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of April and four months ended April 30 compares as follows:

	1909.	1908.
April gross	$ 911,654	$ 865,691
Expenses	569,702	570,663
April net	$ 341,952	$ 295,028
Charges	233,527	232,274
April surplus	$ 108,425	$ 62,754
Four months gross	3,452,007	3,327,457
Expenses	2,233,342	2,203,703
Four months net	$1,218,665	$1,123,754
Charges	939,516	932,436
Four months surplus	$ 279,149	$ 191,318

UNITED RAILWAYS PLAN RATIFIED.

Stockholders of the United Railways Investment Company, at a meeting in Jersey City on May 17, authorized an increase in the preferred stock of the company of $10,000,000, and approved the plan whereby the company, through organization of a new subsidiary car company, will take over the plant of the Stanislaus Power Development, including the Tuolumne Water Power Company, which will supply electricity to the United Railways of San Francisco. Under the plan $1,000,000 of the new stock will be used in payment of the property and the rest will be held for future requirements.

Stockholders also approved the plan for the organization of a new company known as the San Francisco Electric Railways for the purpose of acquiring and operating other street-railway lines in San Francisco and vicinity, and also for the organization of a holding company to acquire both the stock of the San Francisco Electric Railways and that of the new company which is to take over the Stanislaus Power Development. To the acquisition of the stock of the holding company the stockholders under the plan voted $10,000,000 common stock of the United Railways of San Francisco now in the treasury of the investment company.

BOSTON ELEVATED—WEST END.

Governor Draper of Massachusetts has signed the resolve providing for an investigation and report by the Railroad Commission and the Boston Transit Commission on certain matters relative to the West End and the Boston Elevated railways.

The resolve provides investigation on three specific subjects, viz., first, in the matter of the proposed consolidation relating to the distribution of assets of the West End; second, the question of authorizing the Elevated to acquire and hold securities of other street railways; third, the question of authorizing the Elevated to extend its elevated structure from Sullivan Square to Medford. The board is to report to the Legislature in 1910.

DIXON CRUCIBLE COMPANY MEETING.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company, the old board, consisting of George T. Smith, William Murray, William H. Corbin, Edward L. Young, George E. Long, William G. Bumsted and Harry Dailey, was unanimously re-elected. The board of directors re-elected the former officers, namely, George T. Smith, president; William H. Corbin, vice-president; George E. Long, treasurer; Harry Dailey, secretary. William H. Corbin was also re-elected as counsel.

The Electric Illumination at the Alaska-Yukon-Pacific Exposition—June 1-October 16.

The electrical effects at the Alaska-Yukon-Pacific Exposition, which opens at Seattle, Wash., June 1, are most attractive and equal to any of the recent expositions in this country or abroad of its size.

TO THE LEFT THE AGRICULTURAL BUILDING, IN THE CENTER THE FISHERIES, AND IN THE DISTANCE THE AUDITORIUM, ALASKA-YUKON-PACIFIC EXPOSITION.

Among the accompanying illustrations, one shows the illumination of the Oriental Building at this exposition, and another is a night view of the Agriculture Building from across the geyser basin. Adjoining is a day scene along the Court of Honor, while above is shown the Agriculture Building at the left, the Fisheries Building in the center, and the Auditorium in the distance. The method of outline electric-light wiring utilized on the buildings can be noted at the entrance of the building at the right in the immediate foreground of the above illustration.

It is stated that more than a quarter of a million electric lamps are utilized in the illumination of the Alaska-Yukon-Pacific Exposition and that there is required therefor electric power to the extent of over 5,000 kilowatts generated by a hydroelectric power plant in the mountains. The electrical equipment is said to be more complete than that of the city of Seattle itself, while a modern sewer system is provided and an electrically driven pumping plant is utilized for the water system of the fair, which is supplied from a glacier-fed lake in the Cascade Mountains. During the past two years about $10,000,000 has been expended in constructing this magnificent exhibition, whose site is upon the banks of two beautiful lakes in the suburbs of Seattle.

The electrical effects for the cascades and geyser basin are most beautiful, 8,000 gallons of water per minute being pumped by the electric equipment and brilliantly illuminated in fountain and cascade effects. The cascade court is the central feature of the electrical effects of the exposition scheme. There are a series of dams provided for a distance of 500 feet or more, down which a thousand gallons of water runs in a raging torrent over myriads of colored electric lamps placed under the water at the lips of the dam. At night the electrical effects of these lamps are startling, since they are placed behind glass of the prime colors, with shading from the darker tones on the edges to lighter ones in the center. The geyser basin is similarly provided with colored electrical effects, the water being conducted to this basin, as well as to the cascade, through a wood-stave pipe connecting with the electric pumping station, where two electrically driven rotary pumps of the Kruug design are utilized, having a capacity of 10,000 gallons per minute.

The water system of the exposition proper is supplied by three centrifugal pumps of 200 horsepower each, delivering 1,000 gallons per minute to a double line of twelve-inch mains. These pumps are operated by electric motors of the Westinghouse two-phase type, supplied with a current of 2,200 volts pressure at a frequency of sixty cycles per second. The water is pumped from a crib located some distance from the shore line of Lake Washington, three intake pipes, each seven inches in diameter, carrying the water to the electric pumps just referred to. A wireless telegraph and telephone equipment has been installed in the exhibit hall provided for the purpose at the base of a wireless tower 100 feet in height, near the main entrance. This wireless station, placed on the campus of the University of Washington by the United Wireless Company, is in continuous service, receiving messages from steamers entering and leaving the harbor of Seattle.

A series of 1,000-kilowatt motor-generators is provided in the substation at the exposition for supplying light and power service. These motor-generator sets are supplied with current from step-down transformers in the same substation receiving the current at high tension from the transmission line connecting the exposition with the hydroelectric power station.

A complete steam-driven electric generating station has also been installed on the exposition grounds for light and power service as an auxiliary to the hydroelectric power, and this station has also been erected in a permanent structure to be utilized for lighting and power distribution for the University of Washington.

A log building is being utilized during the exposition for the forestry exhibit and is one of the most remarkable structures on the ground. It is one of the chief points of interest and thousands of exposition visitors are attracted by its exhibits. It will be utilized as the Forestry School of the University of Washington when this exposition is over.

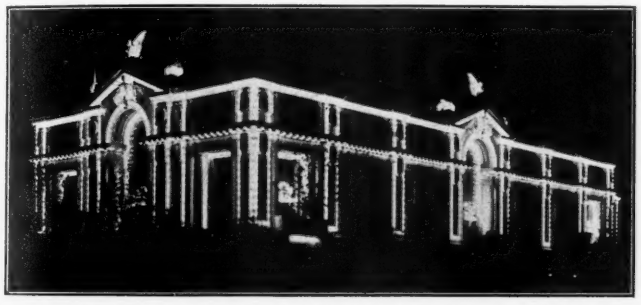
SCENE ALONG THE COURT OF HONOR, ALASKA-YUKON-PACIFIC EXPOSITION.

The Fine Arts Palace is a fireproof building with floors of reinforced concrete

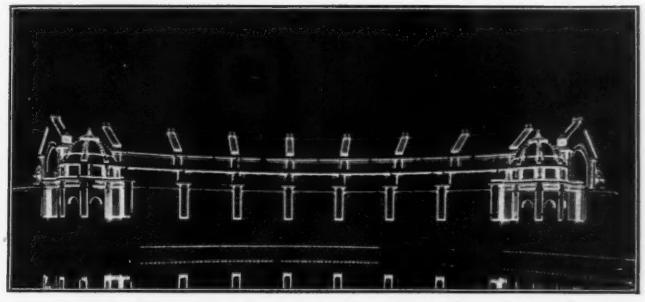
and brick walls with sills of pressed steel, and this permanent building will be utilized as the School of Chemistry at the University of Washington when the exposition is over.

The machinery hall is another permanent building which will be utilized as the University School of Engineering in the future. It is finished in terra-cotta brick, this being the exposition color of the exteriors of all of the exposition buildings, displacing the dazzling white of former expositions.

The California and Oregon state buildings as well as those of Washington and other western states are very attractive and beautiful, while many other very handsome state and foreign buildings have been erected at an expense of several million dollars. The United States Government has expended about two-thirds of a million dollars in order that the Philippines, Alaska and Hawaii may show to advantage their resources and wealth-producing power. The Dominion of Canada has also a fine exhibit. It is stated that the value of all of the exhibits and buildings on the grounds exceeds $50,000,000. This brilliant exposition is showing to the world the great importance of the Northwest and indicates the world's future trade relations with these wonderful lands.



ILLUMINATION OF THE ORIENTAL BUILDING, ALASKA-YUKON-PACIFIC EXPOSITION.



NIGHT VIEW OF THE AGRICULTURAL BUILDING, FROM ACROSS THE GEYSER BASIN.

General Electric Orders.

It is stated that the orders of the General Electric Company since the first of February have been running at the rate of between $51,000,000 and $53,000,000 a year. The orders received in the last fiscal year aggregated $44,000,000, and in the fiscal year ended January 31, 1909, about $60,000,000. The management is of the opinion that orders for the current fiscal year will equal those reported in any year since the company was organized.

The improvement in the business of the electric companies over the last two or three months has been quite marked.

New York Section, Illuminating Engineering Society.

The regular monthly meeting for May of the New York Section of the Illuminating Engineering Society was held on the evening of May 6 at the Twenty-second Regiment Armory in connection with the municipal art exhibit.

It was announced that E. L. Elliott would lecture on "Art in Public Lighting," and some two hundred were present, owing to the numerous invitations which were extended to all who were more or less interested.

The circumstances under which the meeting was held were, to say the least, unpropitious. The committee in charge of the arrangements allowed an estimable gentleman to discourse for a good part of an hour upon public parks and playgrounds, which might have been endurable were it not for the fact that some misguided engineer had placed a number of bare tungsten lamps about the room in such a manner as to shine directly in the eyes of the audience.

The principal feature of Mr. Elliott's lecture consisted of slides showing public lighting fixtures so that the lights were not required. Practically all of the slides were electric and the majority were of conditions in the city of New York. While it is perhaps true that much has been accomplished in that city, it is unfortunate that nothing was shown from any other American city. America has only recently awakened to the possibilities of this form of municipal improvement and, as is usual, the aggregate results make anything accomplished in the same time anywhere else look insignificant. The other slides shown were taken all over Europe and were most interesting.

During the lecture Mr. Elliott called attention to the fact that as little care had been spent upon the proper use of street lamps as upon the fixtures themselves, and also that troubles were greatly minimized when proper care was taken.

The next monthly meeting of the New York Section of the Illuminating Engineering Society will be held on June 10, at 8:15 p. m., in the meeting hall, Engineering Societies Building. At this meeting two papers will be presented, one by Louis J. Auerbacher, entitled "The Evolution and Development of the Flaming Arc Lamp," and one by E. B. Rowe, entitled "The Illumination Efficiencies of Various Types of Lighting Installations," the last-mentioned paper being one prepared particularly for solicitors, dealers, contractors and installing engineers.

Pittsburg Section, American Institute of Electrical Engineers.

The regular monthly meeting of the Pittsburg Section, A. I. E. E., was held in Carnegie Institute, Tuesday, May 11, 1909, W. Edgar Reed, chairman, presiding. The meeting was preceded as usual by a preliminary dinner at the University Club.

The subject of the evening was street lighting, and was presented by C. E. Stephens, of the Westinghouse Electric and Manufacturing Company. Mr. Stephens' paper was well received and the discussion which followed was animated.

F. C. Sargent, of Haverhill, Mass., opened the discussion and gave considerable interesting data regarding various systems of street lighting in use in New England. He was followed by C. F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, and H. N. Muller, chief electrician of the Allegheny County Light Company, who added many interesting details to the discussion.

Others who participated were S. P. Grace, chief engineer of the C. D. & P. T. Company, F. W. Andrew and J. S. Lacock, of the Westinghouse Electric and Manufacturing Company. A number of representatives of municipal councils were present and seemed to have derived much information from the discussion.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A NEW COIL TESTER.

In order to facilitate the rapid and accurate testing of field coils on electric-car motors, and similar coils, the Simpson Coil Tester has been placed on the market by A. G. Brown of Manchester, England. The balancing coils, condenser, etc., of this instrument are contained in a compact teak case, and the whole device is made on the principle of the Hughes magnetic balance. The only preparation necessary for use is to connect the terminals on the outside of the case to any direct-current lighting circuit, with a lamp in series; or, with alternating current, to connect up without the lamp. When the current is switched on a faint buzz indicates that the instrument is ready for use. The coil to be tested is then placed on the baseboard with the projecting coil of the instrument approximately in the center. A "short" in the coil is immediately detected by a loud musical note being heard in the telephone receiver, the intensity of the sound varying with the number of turns on the coil short-circuited. It will be seen that, as no connections need be made to the coil under test, great rapidity, and, it is claimed, absolute accuracy in testing for faulty insulation can be obtained by using this ingenious piece of apparatus.—*Abstracted from the Supplement to The Electrician (London), April 30.*

ONE-COIL AUTOMATIC SWITCHGEAR STARTERS.

Some considerable interest has been recently aroused by a small but significant invention, provisionally patented (British—No. 7,600) by C. W. Denny. It is a combination of the no-voltage and overload release, but is remarkable in that the idea may very well extend to all kinds of automatic switchgear.

There is only one coil—in series with the motor armature—which is wound on the crossbar of an H-shaped magnet. There is a light keeper across the top of the H and a much heavier one across the bottom poles. At normal loads the light keeper is held up to the poles at its end of the H; with undue reduction of current it falls away, and in doing so releases the switch arm in the usual way. It requires an excess of current to attract the other and heavier keeper against gravity; and when this happens the completion of the heavier magnetic circuit, by virtue of its lower reluctance, immediately robs the lighter keeper of its magnetic flux, so that it trips and releases the switch arm, as before.

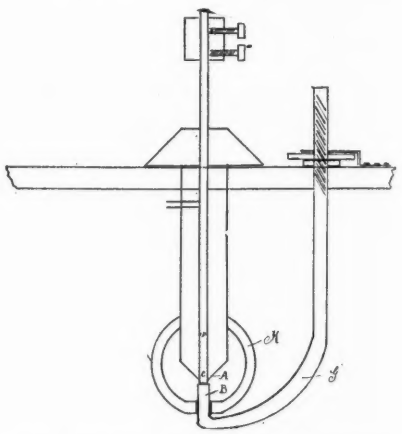
This is distinctly better than the usual two-coil arrangement, and insurance offices will be glad to find a starter in which the most troublesome feature promises to be made simpler and more trustworthy—certainly cheaper.—*Abstracted from the English Mechanic and World of Science (London), April 30.*

AN ENGLISH TRADESMAN'S EXPERIENCE WITH METALLIC-FILAMENT LAMPS.

The following costs data have been received from a suburban tradesman, showing a comparison between the old carbon-filament and the new metallic-filament incandescent lamps, in a district with a 200-volt alternating supply. During the first year his lighting was obtained from nine three-light clusters of eight-candlepower carbon lamps, the aggregate illumination being thus 216 candlepower. His bill for the year ending June, 1907, amounted to $91.22, and purchase and renewals of lamps cost a further $14.32, bringing the total outlay on light up to $105.54 for the year. Toward the end of 1907, several of the three-light clusters were replaced by single pendants carrying 100-volt, thirty-two-candlepower osram lamps running two in series. Early in the following year the other clusters were converted, and in April when the 200-volt tungsten lamp was introduced, the remaining carbon lamps were replaced by them. When this had been done the total illumination was 324 candlepower, the initial cost of the lamps being $10. Since this date six new 100-volt metal lamps have been bought to replace breakages, bringing up the total cost of osram lamps and renewals to $15.96. For the year ending June, 1908, the cost of current had come down to $66.92, and for the four quarters ended December, 1908, to $53.82. This compares with $88.62, the cost of current for the corresponding period of the previous year, but since for a portion of 1908 carbon lamps were still in use, the figures for the four quarters to June next should show a still better result, since they will relate to osram lamps alone.—*Abstracted from the Electrical Times (London), April 29.*

ELECTROLYTIC CARBON INTERRUPTER.

In the Wehnelt interrupter, which is now well known, the anode nearly always consists of platinum. This metal is unsurpassed when direct current is to be interrupted, but with alternating current it is rapidly disintegrated, which makes its use expensive. H. Kost describes an interrupter for alternating current, in



ELECTROLYTIC CARBON INTERRUPTER.

which the platinum is replaced by carbon. A lead plate and a short porcelain diaphragm with a three-millimetre hole are placed in a vessel filled with sulphuric acid (H_2SO_4, relative density 0.16 to 0.22). At the lower end of the diaphragm there is a wide porcelain ring K provided with a hole directly opposite the opening A. A small porcelain cylinder B, which extends into the hole, can be regulated by the arm G in order to produce changes in current strength and number of interruptions. The anode itself consists of carbon covered electrolytically with a thin metal coating, preferably copper. The thickness of the coating determines the maximum admissible current intensity. A weight presses the carbon against the porcelain cylinder B and maintains the anode at the length at which it has been set. A decrease in the cross-section of the carbon will increase the number of interruptions, when

direct current is used; with alternating current it is, of course, dependent on the number of periods. The interrupter operates well up to a temperature of eighty-five degrees centigrade, and even at ninety degrees centigrade, but in this case the surface must be increased in order to preserve the regularity of the interruptions. The tension necessary for the operation of the device varies between sixty and 150 volts. Excellent results were obtained with an interrupter of this kind and an induction coil of twelve centimetres spark length. The Roentgen light was remarkably steady, although produced by alternating current.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), April 18.*

ELECTRICAL PUMPING IN COLLIERIES.

At a recent meeting of the South Staffordshire and Warwickshire Institute of Mining Engineers (England), S. F. Sopwik made some interesting remarks on the relative merits of the different electric pumping systems for collieries. His general deduction was that for simplicity, combined with efficiency, the triple-ram type of pump was hard to beat; but as space was generally a consideration of importance, and the single-ram differential type showed a very high efficiency, this type would find many advocates, especially when it became better known. The centrifugal or turbine pump, although of comparatively small size and cost, had not yet shown such efficiency for high lifts as to warrant its use in any but exceptional circumstances.—*Abstracted from the Mechanical Engineer (Manchester, Eng.), May 7.*

SILICON COMPOUNDS FROM THE ELECTRIC FURNACE.

The number of silicon compounds which the electric furnace can furnish does not appear to be exhausted. The well-known carborundum is silicon carbide, SiC. Some time ago Henry Noel Potter described a new silicon monoxide SiO. He now prepares silicon free of carbon from carborundum and silica SiO_2, under addition of carbon, and refines the resulting product in an arc furnace of 150 volts, in which a mixture of silica, silicon carbide, and carbon surrounds the upper of the two vertical electrodes. Frank J. Tone proposes to mix aluminum silicate (kaolin) with sufficient carbon to reduce the silicon, but not the aluminum; he thus obtains alumina and silicon. The reaction is facilitated by adding some iron metal or ore, so as to bind the silicon. In that case ferro-silicon is obtained, which is tapped off or found in nodules in the alumina. Some of these silicides, *e. g.*, the manganese silicide with fifty per cent of silicon, are friable, and disintegrate on exposure to the air. Suitable proportions of aluminum silicate and carbon yield a fused mixture, of about seventy-five parts of alumina and twenty-five parts (from five to thirty-five) of silica, in the shape of a homogeneous, very hard and tough material, which, it is said, can be cast in molds and can be utilized as an abrasive and a refractory material.—*Abstracted from Engineering (London), May 7.*

A LARGE STORAGE BATTERY.

The Manchester (Eng.) Corporation has placed a contract for a storage battery to be installed at its Dickinson Street generating station, which is interesting, not only on account of its large size, but also on account of the method of its employment. Speaking generally, the intention is to use the surplus power from the traction generator available in the daytime for charging up the battery, at a cost very little more than that of fuel, and discharging the battery over the lighting peak and traction peak. It is probable that it will be called upon for two complete discharges per day, so that the service will be rather severe. The battery will consist of 210 cells in series, and is to maintain with one of the boosters a voltage of 450 across the lighting busbars. When required for traction service two of the boosters will be run in series. Charging will be carried out from the 525-volt traction busbars under the conditions outlined below. The following discharge rates are guaranteed: 8,400 amperes for one hour, 5,000 amperes for two hours, 3,900 amperes for three hours, and 11,200 amperes for half an hour. It is further to withstand a maximum discharge rate of 15,000 amperes. The normal charging rate is to be 4,100 amperes, and the maximum charging rate 6,500 amperes. The containing cells are to be of pine wood, lead-lined, coated inside and out with acid-proof paint. The outside measurements of each cell will be six feet, one-and-one-half inches long by two feet, two-and-one-half inches wide by three feet, four-and-one-half inches deep, and the dimensions of the plates, which will be cast in one piece, will be twenty-and-three-fourths inches by twenty-nine inches. The weight of each cell will be about three long tons, and the total floor space occupied by the battery will be about 5,800 square feet. The boosters will be three in number and of the reversible type. Each set is to consist of a motor driving one booster. The boosters will be separately excited, and are to have laminated-field systems, to allow of rapid reverse. Each motor is to be capable of driving the booster at all loads when running off the traction 525-volt circuit, or the lighting 425 to 450-volt circuit. The capacities of the boosters are specified as follows: 2,800 amperes at 100 volts for fifteen minutes; 2,000 amperes at eighty volts for four hours; 2,800 amperes at sixty volts for one hour; 3,700 amperes at eighty volts for half an hour. The boosters, when the battery is on the lighting load, will be connected one, two, or three in parallel, according to the load, separately excited off the busbars, and hand-regulated; but when the battery is on the traction load two of the boosters will be used connected in series. One of these will be excited from the traction bars and hand-regulated, and its object will be simply to give a constant boost equivalent to the difference between the lighting and traction voltage. The other booster will be arranged so that its field is regulated automatically in order to cause the battery to take up the fluctuations of the traction load, and thus render it possible for the traction generators to run on a practically constant load. The differential windings by which this automatic regulation is effected will not be on the booster fields, but on special exciters provided for the purpose. These exciter sets, of which two will be provided, one serving as a spare, will be driven independently by their own motors.—*Abstracted from Electrical Engineering (London), May 6.*

Naval Tests of Wireless.

Washington, D. C.—Experts of the United States Navy are bending every effort toward perfecting wireless equipment, both telephone and telegraph, for use by the vessels and shore stations. The military authorities also are carefully investigating this subject through the Signal Corps.

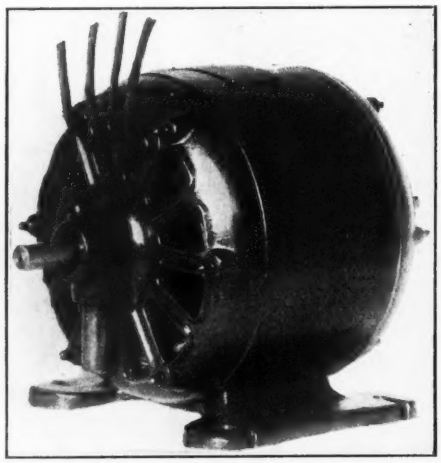
Both the navy and the army will be represented at a series of experiments to begin about June 15 at Brant Rock, Mass., where a high-powered wireless station has been erected by a concern which is endeavoring to secure the work of building and equipping a 600-foot tower in Washington. Special requirements are exacted as to the distance capability of the apparatus used.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Small Single-Phase Motors.

To meet the growing demand for small motors below one-fourth horsepower that has sprung up so extensively for industrial and domestic use the Westinghouse Electric and Manufacturing Company has developed what is known as type DA small motors for single-phase alternating-current circuits. These machines are extremely simple in design and in operation. They are of the squirrel-cage rotor type and require no contact brushes or regulating resistances of any kind. They are started and snapped by simply closing an ordinary knife or snap-switch. Occasional oiling is all the attention that is required under ordinary conditions.



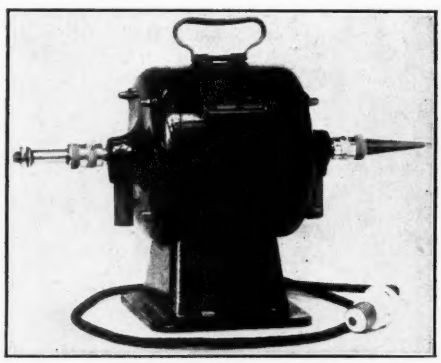
SMALL SINGLE-PHASE WESTINGHOUSE MOTOR.

The frames of the machines are cylindrical with cast-iron bearing brackets. Some of the motors are entirely enclosed where it is desirable to keep anything from coming in contact with the rotor. The windings on both the stator and rotor are placed in insulated slots. The bearings are of the wick-feed, self-oiling type, and are provided against oil dripping or splashing. Many of these motors are provided with means for reversing by bringing out four wires through bushed holes in the bearing brackets. In order to reverse the rotation of the machine the wires coming from the two inner holes are interchanged.

Ordinarily these motors are provided with a two-step grooved pulley for use with round belting. They can be arranged for driving special machinery by the use of clutches and convenient connection. They can be also provided with automatic centrifugal clutches for starting with overloads. The latter provision is particularly valuable for overcoming high-standing friction of machines. The clutch does not act until the rotor has approached practically full speed, and then a gradual gripping of the clutch starts the load with little shock.

Among the manifold uses for which these motors are adapted are the following:

Operation of suction-type carpet-sweepers, driving of washing machines of either vertical or horizontal type, and running of sewing machines in the way of household applications. For industrial purposes they find ready use in running ironing and marking machines in laundries, driving coffee and meat grinders in stores, operating adding machines, envelope sealers and stampers in offices, erasing machines for drafting rooms, as well as blowers, air pumps and water pumps of various types, and for operating lathes and other small machinery.



WESTINGHOUSE SINGLE-PHASE BUFFING, POLISHING AND GRINDING MOTOR.

These motors are made in sizes from one-twentieth to one-fourth horsepower and for either 110 or 220 volts. They are carried in stock for frequencies from twenty-five to 133 cycles per second.

Several of these motors were shown at the Westinghouse Company's exhibits at the Cedar Rapids (Iowa) and other recent electrical shows, and aroused much favorable comment from the central-station men present.

An Improved Ventilating Fan.

To meet the demand for a reasonably priced ventilating device the Central Electric Company, Chicago, Ill., is marketing the fan shown in the accompanying illustration, and which is particularly adapted for ventilating hotels, cafes, restaurants, saloons, stores, bakeries, factories, theatres, churches, schools, hospitals and other public places where a continual renewal of the air supply is absolutely necessary.

This fan is made in both direct-current and alternating-current types, twelve and sixteen inch, and embodies the latest improvements in motor design, all the parts being perfectly balanced and mounted in improved bearings, thus insuring minimum attention and noiseless operation.

IMPROVED VENTILATING FAN.

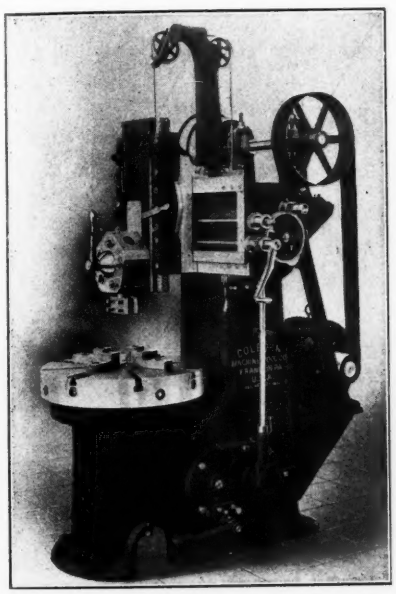
Particular attention has been given to the design of the supporting frame and a construction has been devised which is not only simple and strong, but which is easily installed or removed.

The motor bodies and supporting frames are finished in dull black marine, the blades, brush holders and oil cups being finished in polished lacquered brass, thus securing a combination which is durable and pleasing in appearance.

Both the direct-current and the alternating-current motors are wound for use on 100-125 or 200-230 volt circuits, as desired, the latter also being wound for twenty-five, thirty, forty, sixty, 125 or 133 cycle circuits.

Motor-Driven Vertical Boring Mill.

In the accompanying illustration is shown a very serviceable boring mill especially adapted to automobile work, although it can be used for different work. The mill is adapted from a standard belt-driven outfit to motor drive by the addition of a countershaft and a constant-speed, five-horsepower Westinghouse direct-current motor mounted on special brackets at the rear of the machine. This arrangement makes the boring mill independent of line shafts and all other machines, and reduces trouble from belting because the belts are shorter and on shafts which are mounted on the same frame, and thus cannot get out of alinement. The speed changes are made mechanically by



COLBURN MOTOR-DRIVEN VERTICAL BORING MILL.

the cone pulleys and by the gears in the base. There are in all sixteen different speeds, which give the table speeds from two-and-three-eighths up to sixty-eight-and-three-eighths revolutions per minute.

The boring mill is equipped with a five-sided turret which permits five or more operations to be performed on one piece of work in any direction without stopping the machine or changing the tool. The turret is mounted on a vertical slide which may be swiveled to any angle up to thirty degrees on either side of the perpendicular. This arrangement is unique and is accomplished by first locking the weight by means of the clamp on the sheave-wheel bracket on top of the machine, and then by turning the crank on the vertical-feed shaft.

The feeds are positive, gear-driven, for both vertical and horizontal motions, and are provided with adjustable automatic stops. There are eight available feeds for any speed of the table. A special attachment is provided for thread-cutting, which may be readily applied, and, if desired, can remain permanently attached to the machine without interfering with its regular operation.

Some of the regular work which this boring mill is performing in automobile factories may be mentioned as follows: Machining cast-iron flywheels, including roughing and finishing cuts in the face,

HOLWICK ELECTRICALLY-DRIVEN COFFEE GRINDER.

finishing both edges, rounding outside and chamfering inside corners, boring taper hole through the hub, reaming it with taper reamer and facing the hub on one side; machining the air-cooled cylinder; machining steel housing casting for differential gear on rear axle, including facing the outside edge, boring, reaming and tapping the hub, and threading the outside of the hub.

The boring mill is manufactured by the Colburn Machine Tool Company, of Franklin, Pa.

Electrically-Driven Coffee Grinders.

The use of electric motors to drive coffee mills is growing very rapidly because of the perfect satisfaction given by the motors and the time and annoyance saved by having a machine to grind the coffee instead of being compelled to do the work by hand. Progressive grocers everywhere appreciate the advantage of having a clerk spend his time waiting on a customer and not turning a handwheel, because it pleases the customer to be waited on promptly.

The coffee mill illustrated is manufactured by B. C. Holwick, of Canton, Ohio, and is equipped with an alternating-current single-phase Westinghouse motor. The outfit is an excellent combination of strength, durability, neatness and service.

The grinders are milled from steel plates, which give them true and sharp cutting edges, causing them to cut the coffee instead of crushing it. Steel-cut coffee is far more uniform in size than crushed coffee and is free from dust, and for these reasons gives a better flavor.

The mills are provided with a simple adjustment by which it is possible to change from coarse to fine grinding or the reverse while running, and will granulate two pounds of coffee per minute at a cost of one-thirtieth of a cent a pound. A durable self-cleaning attachment is provided.

Several of these mills on the circuits of a central station add to the revenues without increasing the peak load. Progressive managers, who are endeavoring to increase the sale of power current among the merchants, find the motor-driven coffee mill one of the easiest propositions in which to interest the grocer.

A New Electric Toaster-Stove.

The compact and artistic electric toaster-stove, herewith illustrated, combines the advantages of an alcohol lamp with many of the features of a whole kitchen range. By its use toast, cakes, muffins, scrambled eggs, and a dozen other dishes may be made and served piping hot on the breakfast or tea table.

The construction of the toaster-stove may be readily seen from the illustrations. For toasting, the heater surface is covered with a wire grid, as in Fig. 1. Used as a cooker, the steel top replaces the wire tray, as in Fig. 2, providing a hot surface for any ordinary cooking operation. If necessary, the steel top may be inverted, turning up a narrow rim which serves to retain fluids on the hot plate. The toaster-stove handle can be removed and used as a pancake turner, as shown in Fig. 2. The toaster-stove will heat water in a very short time and makes an admirable hot plate for keeping food warm. It cannot overheat or burn out,

even if left in circuit continuously. In any home innumerable uses will be suggested for this handy little electric heater,

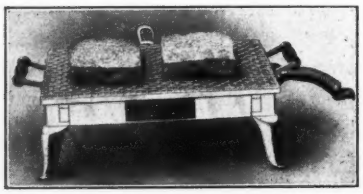


FIG. 1.—TOASTER WITH WIRE GRID.

which is always available for immediate use.

The toaster-stove, which is made by the Westinghouse Electric and Manufacturing Company, measures seven by eleven inches, weighs five pounds, and is finished in nickel steel. It is furnished complete with heater, toasting grid, cooking tray, de-

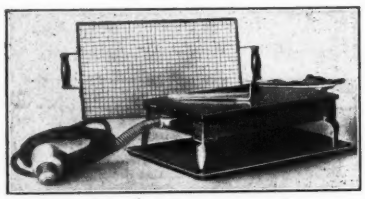


FIG. 2.—TOASTER-STOVE WITH GRID REPLACED BY STEEL TOP.

tachable cord connection, and crumb tray. The heating element is of the well-known Westinghouse type, and is practically indestructible. The toaster-stove consumes 500 watts, and is made available for any voltage from 100 to 125 volts.

The Chicago Yards of the Naugle Pole and Tie Company.

The accompanying illustration shows the method of unloading and decking poles in the Chicago yard of the Naugle Pole and Tie Company. The capacity of the unloading machine is from eight to ten cars a day. This does not limit the capacity of the yard, as the company can load smaller poles, posts and ties by hand. When necessary it has been possible to load as many as thirty cars a day, including posts, poles and ties.

The Chicago yard represents only a small portion of the company's stock; large yards are located on the Minneapolis & International Railroad, the Great Northern, the Northern Pacific, the Duluth, South Shore & Atlantic, and there are also several smaller points on the Northwestern & Milwaukee. From these points the company ships direct to the consumer, in this way allowing it to ship practically from the woods to the man who sets the poles.

A great deal of the Chicago stock comes from Canada and from the American shore of the Great Lakes. As low freight rates to Chicago from these points are available, the material comes as cheaply to this center as it would to any other point, and the Chicago yard is therefore of great advantage to the company.

A New Electric Annunciator.

The increasing demand for a good, reliable annunciator, due to the erection of so many new modern office buildings, hotels and apartment houses, has led Edwards & Co., Inc., of New York city, to place on the market a new type of lock gravity drop annunciator, known as the Dixie (see Fig. 1). This type has the same fine cabinetwork and finish as the Edwards annunciator, and, in addition, has several new features.

The well-known 8-B Lock Gravity Drop, which is positive in operation, is supplied in this type, as well as the standard bells and buzzers used on all Edwards annunciators. The annunciator is in two parts, the backboard and the case. On the backboard (see Fig. 2) the bell, drops and connectors are mounted. When the annunciator is to be installed the case is unhooked and removed—no screws to take out or replace—and the backboard is screwed to the wall. Connections can be easily made, as the connectors are neither outside nor on top of the case, but in plain view at the bottom of the backboard. Hence in this case it is not necessary to work through or between the drops.

Since the bell is also on the backboard, test can be made while the case is off, and the working parts exposed. When the work of installation is completed, the case is hooked on with good, substantial hooks,

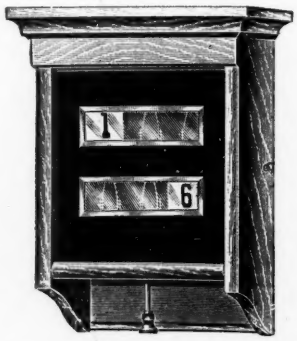


FIG. 1.—DIXIE LOCK GRAVITY DROP ANNUNCIATOR.

thus protecting the instrument from dust or damage.

Only a small amount of current is re-

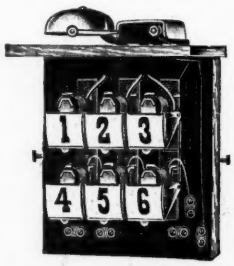
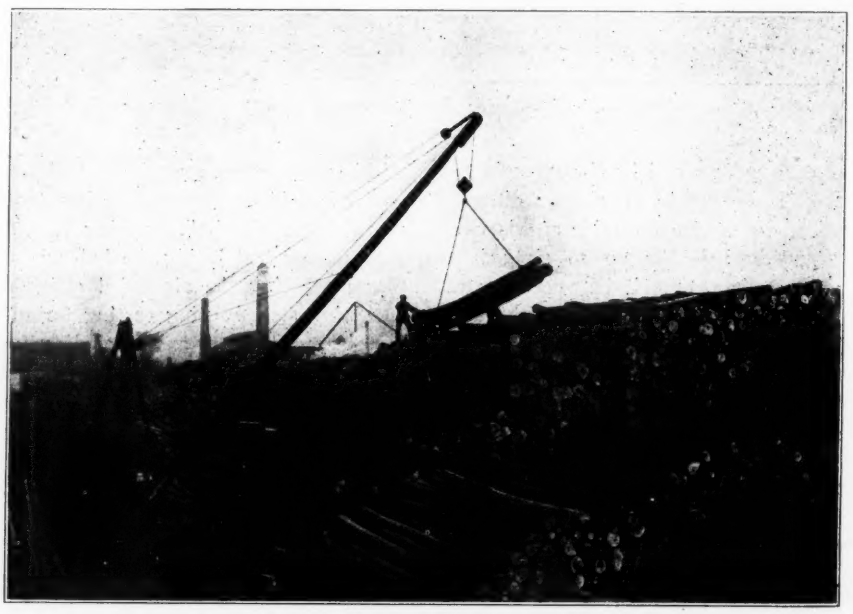


FIG. 2.—BACKBOARD OF ANNUNCIATOR.

quired to operate these drops because of their simplicity and ease of operation.

These instruments are regularly supplied in well-seasoned quartered oak, but any other standard hard or fancy woods, such as maple, walnut, birch or mahogany finishes, are obtainable.

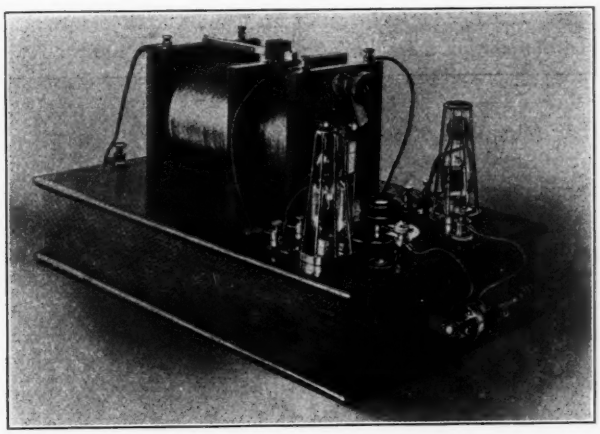


CHICAGO YARD OF THE NAUGLE TIE AND POLE COMPANY.

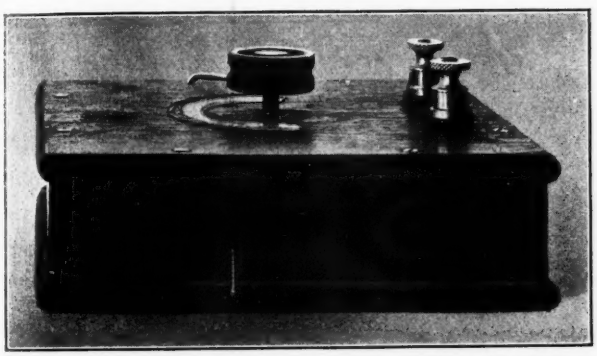
De Forest Wireless Telephone and Telegraph Apparatus.

A complete assortment of apparatus adapted for wireless-telephone and telegraph service has been manufactured by the Radio Telephone Company of New York, N. Y. There have been provided complete sets for radio-telephony on the de Forest system, as well as individual parts of the equipment that may be used in connection with other systems or in connection with experimental laboratory work in general.

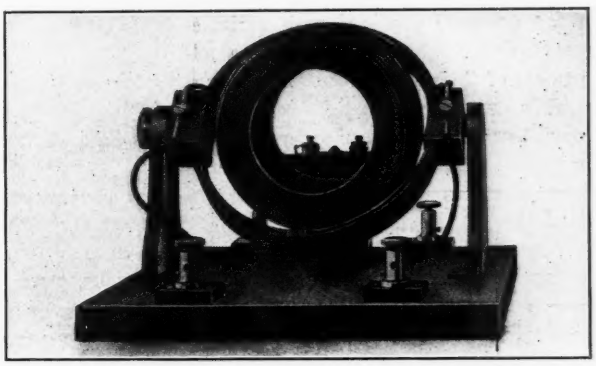
DE FOREST STANDARD NAVY TYPE RADIO-TELEPHONE.



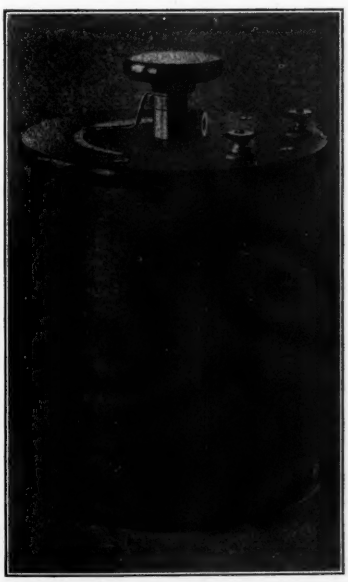
COMBINATION SYNTONIZER AND RECEIVER.



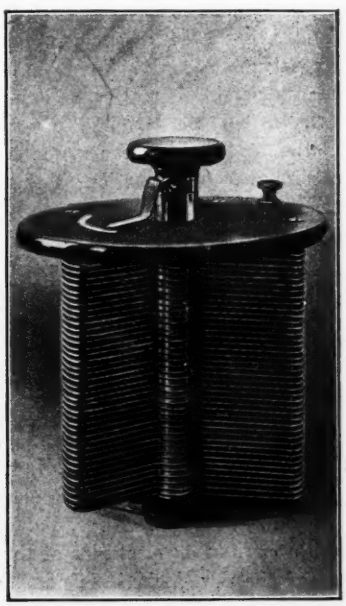
TYPE V-C-1 VARIABLE CONDENSER.



LOOSE COUPLING APPARATUS.



TYPE V-C-2 VARIABLE CONDENSER.



TYPE V-C-3 VARIABLE CONDENSER.

The standard navy-type radio-telephone apparatus, as shown in the accompanying view, consists of a de Forest transmitter, "audion" and "radion" receivers, a tuner, and a small telegraph adjunct, called the "chopper" telegraph. This latter device is really an electric buzzer operating with a telegraph key, and is used in calling up the stations and in transmitting telegraph messages when desired. The operator can readily switch from the telephone to the telegraph. There is also included a two-horsepower engine for land service or a one-kilowatt dynamotor for use on shipboard.

The transmitter includes appropriate choke coils, rheostat, main-line switch, variable condenser, primary and secondary coils that are variable both as to mutual and self-inductance. The equipment is entirely enclosed in a handsome wooden case, upon the front of which is mounted a special microphone, with an index lamp and antenna switch. To enable quick changing of tuning, a slide with a scale is provided, which permits of a change of wave length from 350 to 1,300 metres. An enclosed arc lamp is also provided, which follows the construction used by Tesla, with automatic feed regulation, mounted on one side of the transmitter case. The arc mechanism has been so perfected that the arc requires practically no attention and operates very quietly,

allowing fine articulation with maximum range. The audion receiver is of the grid type, mounted in a heated gas in a vacuum bulb. It is singularly free from atmospheric disturbance and retains its high sensitiveness throughout.

This company has also made up demonstration outfits suitable for school and lecture purposes, that comprise complete wireless-telephone and telegraph equipment. This type of outfit is made much more compact than the standard equipment, but permits of a study of all the laws of oscillating currents, the phenomena of syntony and prevention of interference, as well as the general demonstration of "wireless" methods.

A combination syntonizer and receiver apparatus has been prepared as a separate unit. It is really a very simple form of a variable coupling tuner provided with a de Forest audion receiver and a Seift radion detector. Both primary and secondary coils are provided with variable-contact devices that allow complete adjustment of their inductance. These syntonizing units are arranged for use with either batteries or transformers. There have also been built special syntonizing units for work requiring the greatest sensibility and for eliminating extreme interference. A special telephone receiver of the head type is used with the de Forest wireless-telephone equipment.

In the syntonizing equipment, use is made of variable-inductance coils that have also been provided as separate units. They have been built in three different sizes. The principle of construction of these variometers is the same as that used in the building of standard variable inductances, which consists in the use of two concentric spherical surfaces upon which the primary and secondary coils are wound. The angular position between these coils is adjustable to a high degree, giving a large range of inductances. A triple variometer consists of three variable-inductance sets, connected and placed one behind the other, and enclosed in a portable case. The range of adjustment of each of these sets is different from that of the others, so that, by a combination of the three sets, a range from 330 to 290,000 centimetres is obtained.

A form of variable condenser has been built also as a separate unit. These condensers are arranged with a large number of semicircular segments of aluminum mounted on a brass spindle, and adjustable by means of an ebonite turning knob and locking device. The condensers are mounted in either a glass or nickeled brass cylinder, that is filled with a special oil of high dielectric strength. The standard condensers are built for voltages not exceeding 500, and have a range in capacity from 0.00005 to 0.005 microfarad. These condensers likewise can be used for various experimental purposes and are quite suitable as standards of capacity.

To increase the efficiency in undamped-wave transmitters, close tuning of the receiving apparatus is very important. To secure sharpness of tuning, it is necessary to use a loose-coupling method between the oscillatory and receiving circuits. To provide for this method conveniently and accurately, a loose-coupling apparatus has been built which works on the principle used in the variometer, that is, two spherical coils are mounted in this case on a horizontal axis. The inner coil is a stationary one and can be readily removed and replaced by another having different inductance value. The outer coil can be clamped in any position, and can be used either as the primary or the secondary in the oscillating transformer.

Electric Motors on Docks.

The convenience of electric motive power is well illustrated in the applications shown in the accompanying illustrations, where electric motors are shown connected to a capstan and a winch for use in hauling vessels up to the dock. In each case the outfit is entirely self-contained with the entire outfit on a single bedplate, which insures correct alignment of the gearing even after long service. This construction makes the installation of the outfit a simple matter, as it is only necessary to bolt the bedplate to a secure foundation and connect the motor to the power circuits. The location of the capstan may be chosen without reference to the power, for the wires may be run anywhere on the dock with much greater convenience at a substantial saving as compared to any other method of supplying power.

Fig. 1 shows one of the two electric capstans supplied by the American Ship Windlass Company of Providence, R. I., to the Newport News Shipbuilding and Drydock Company, installed on piers in the shipyard at Newport News, Va.

With a capstan on each pier at the entrance of the dry dock, it is possible to haul the ships in very rapidly and accurately. The dock is one of the largest at any of the shipyards in the world and will take the largest American battleships now afloat. It may readily be appreciated that powerful machines are required to do such work. Each winch is designed to pull 11,000 pounds at thirty feet per minute. The motors are standard Westinghouse type K, series wound motors, running at a full load speed of 560 revolutions per minute.

The capstan is known as a sixteen-inch electric gypsy, that is, the barrel is sixteen inches in diameter at its smallest part. The hauling rope is merely wound

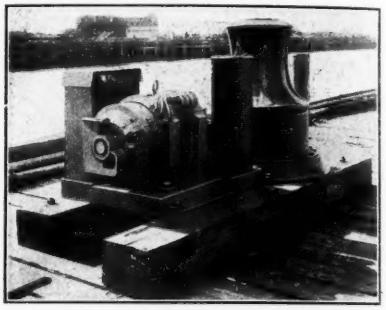


FIG. 1.—ELECTRIC CAPSTAN DRIVEN BY WESTINGHOUSE SERIES MOTOR.

around the barrel four or five times and the loose end of the rope overhauled as the vessel is pulled into the dock by the winches.

Fig. 2 shows a powerful winch which was installed by the Interborough Rapid Transit Company, New York city, to haul barges alongside of the dock at its power station. It is driven by a twenty-five-horsepower, three-phase induction motor of Westinghouse manufacture. With the motor running at 240 revolutions per minute the winch will have a speed of twenty-four feet per minute and exert a pull of 18,000 pounds.

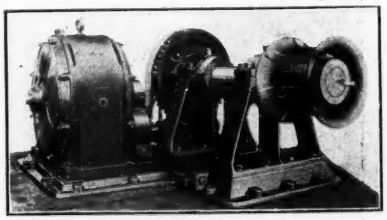


FIG. 2.—ELECTRIC WINCH DRIVEN BY WESTINGHOUSE INDUCTION MOTOR.

It will be noted that in the first case, at Newport News, series wound, direct-current motors are used, and in the second case at New York, a three-phase induction motor of the short-circuited secondary type is used. In each case the conditions are practically the same and the different types of motors are giving satisfactory service.

All of the winches were furnished by the American Ship Windlass Company of Providence, R. I.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MAY 8.—There seems considerable probability of a railless electric traction scheme being put into force in Great Britain. Hitherto, although a number of these proposals have been placed before various town councils, even if they had been accepted there would have been a delay of something like eighteen months while the necessary parliamentary sanction was being obtained. Reference has been made to Sheffield, where a different state of affairs exists. Already the Corporation possesses Parliamentary powers to run motor omnibuses, but a sub-committee of the tramways committee has recently investigated the various systems of electrically driven trolley buses with the result that it has recommended a definite scheme in which the Mercedes-Stoll system would be adopted. Further, the tramways committee has confirmed the recommendations of the sub-committee. An experimental route of about two-and-one-half miles is proposed at an estimated cost of £7,500 for overhead equipment and £1,800 for cars.

What is believed to be the largest battery ever installed for public supply or any other work has just been ordered by the Manchester corporation, and will be used to help the peaks both of the lighting and traction. The battery is to have a capacity of 11,700 ampere-hours and the decision to install one of such a large capacity may be said to be a triumph for A. M. Taylor, of the Birmingham Corporation electricity department, who has been very conspicuous in recent years in urging the adoption of this class of battery for such purposes. The results at Manchester will naturally be awaited with extreme interest, and in the meantime the question of the guarantees which battery makers will give with batteries of such large size will receive renewed attention.

The London County Council intends to promote legislation in the next session of Parliament to enable it to deal with block smoke nuisances in the county. At present each local authority deals with its own local cases, and the County Council has no jurisdiction.

The annual meetings of the tramway companies are producing a considerable number of complaints as to the attitude of local authorities toward tramway enterprise. The unstable financial condition of many tramway undertakings is attributed to the action of the local authority in demanding more than the undertakings will stand in the way of rents, contributions toward road widenings, etc., usually followed up by requests for greatly reduced fares and special rates for school children, police, and so on. One company has declared its intention of not again promoting fresh undertakings in this country while the present position of affairs continues.

Upon the London County Council tramway system there is an outstanding debt of $36,310,700. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, MAY 8.—The region in the neighborhood of Marseilles is supplied with current from two electric plants lying within the city. One of these plants is located beside the gas works and has been erected within a recent period, containing a number of Curtis turbine and alternator groups of 3,000 to 1,000 kilowatt size. The station is used principally for the city tramway lines. The second station, known as the St. Giniez plant, is of older date, and also furnishes part of the current for the tramways. The capacity of this latter station has been increased quite recently by the addition of a Curtis turbine unit of 1,000 kilowatts. Like all the other steam turbines it is built at the Paris works of the Thomson-Houston Company.

Among the new companies to be recently formed in France, the following may be noted: Compagnie Parisienne d'energie electrique, Omnium Francais d'Electricite, Marconnet Gas Producer Company, all of which are located at Paris, besides a company which has been formed for operating an electric railroad in the suburbs of the city from Sevran to Claye-Souilly and Raincy. Another Paris company, Brandon Brothers, is occupied with patent affairs. The Paris Motor and Producer Company and the Gillon lamp manufacturing firm, are also of recent formation, and at Dijon there is the new Cote d'Or tramway company. The Paris Electric Distribution Company has recently increased its capital from $10,000,000 to $20,000,000. At Monza, Italy, in the neighborhood of Milan, two new companies have been formed, one of which, the Antonnetti firm, will handle electric apparatus, while the Larghi firm is to manufacture various electrical supplies.

An electric-lighting project of some scope is being considered at Lisieux, France. It is intended to erect a large electric plant at this point in order to supply an extensive district, including many large towns lying in three departments. A tramway line will probably be constructed shortly from Nice to a neighboring point in the Maritime Alps region known as La Turbie. In Austro-Hungary an electric railroad is to be built from the town of Bartfeld to the suburban region. The town of Souvalki, Russia, is shortly to erect an electric-lighting plant.

Additional new companies concerned with the electric industries formed on the Continent are the Crozant Electric Power Distribution Company, having its headquarters at Paris; the G. Aboilard Company and the Material and Enterprise Company, also of Paris; the Petit Morin Electric Lighting Company, at Forge; the Light and Water Company, of Nancy.

On the Continent there are only a few of the large cities which are using a garbage-consuming system, these being Hamburg, Zurich, Monaco and Brussels. At Zurich the furnaces are used to operate a steam turbine dynamo unit. One of the most recent plants is that which is erected at Brussels, and it contains a battery of Horsfall garbage furnaces constructed on an improved plan.

At a recent meeting of the Société des Electriciens of Paris, Prof. Riccardo Arno, of Milan, described a new measuring apparatus for telephone currents and in general for high-frequency alternating currents. It consists of a galvanometer with fixed coils and a movable suspended part. When placed in series with a 100,000-ohm resistance and a Bell transmitter, simply speaking into the telephone will give a noticeable deflection of the galvanometer owing to the current which is set up in the telephone. At the same meeting a paper was presented by J. Bourdel on the question of electric traction by direct current on the constant current system.

A syndicate has been formed in Norway for developing the recent invention of Dr. Schönherr, a German scientist. He has devised an electric method for producing nitrous products from the air by the use of the arc. It is an improvement on the well-known Birkeland and Eyde process, and the arc is formed inside an iron tube, being blown into the tube for a great length by means of a continuous air current. A 140,000-horsepower turbine plant is now being erected in Norway on the Rjukan River, in connection with an extensive plant using the above process.

The military and civil authorities of Marseilles, with the aid of the Chamber of Commerce, have completed arrangements for wireless telegraphy and automobile service to insure the continuation of the transmission of telegrams and letters in case of a strike. A. DE C.

CANADA.

(Special Correspondence.)

OTTAWA, MAY 10.—The ratepayers of the town of Listowel, Ont., have passed a by-law to install a municipal electric-light plant for street and commercial lighting.

The Railway Commission for Canada has handed out an important judgment defining a general rule under which independent or other telephone companies may be allowed to install their lines in railway stations without regard to the fact that such are already served by the lines of another company. The railways, most of them being served by the Bell Company, opposed the independent lines being admitted. The judgment is a win for the independents.

The Ontario Hydroelectric Commission has decided to install a protective system for its entire transmission line. The change is made in view of recent accidents and fatalities, to insure absolute safety. Engineer Sothmann pronounced the system the best in the world. The electrical equipment of the protective system in the stations will be supplied by the Westinghouse company. The contract for the suspended insulators, which will be used on the tower lines, was let to the Ohio Brass Company, of Mansfield, Ohio.

The hydroelectric power will be one of the greatest sources of Canadian national wealth in the future. A conservative estimate places the waterpower of the Dominion at nearly 26,000,000 horsepower. Converted into coal, on a basis of five pounds of coal per hour per horsepower, this means some 551,000,000 tons of coal per annum. This statement was made before the parliamentary committee of the Canadian parliament by R. E. Young, superintendent of Dominion railway lands. The province of Quebec has 17,000,000 horsepower, Ontario over 3,000,000, British Columbia 2,000,000, Alberta 1,000,000, Northwest Territories 600,000, Saskatchewan 500,000, Manitoba 500,000, New Brunswick 150,000 and Nova Scotia 54,000. Apart from Ontario,

however, the estimate is crude, but too conservative, which was the purpose of Mr. Young. He quoted Professor Shortt as saying that that part of Ontario and Quebec, to the south of James Bay, would be the manufacturing center of North America.

A. V. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

MISSISSIPPI VALLEY PROJECT—Bankers of Milwaukee, Chicago and Madison have incorporated the Interstate Light and Power Company with a capital stock of $750,000. It is considered the beginning of one of the most extensive electric transmission projects in the Mississippi Valley. The company will supply several Wisconsin and Illinois cities and towns with electricity for both lighting and power purposes. It has acquired the contracts of the Tri-State Light and Power Company of Galena, Ill., and the Platteville Electric Light and Power Company of Platteville, Wis. A power station is to be built at once in Galena.

POWER FOR COLORADO MINES—The Golden Cycle Mining Company has completed a deal by which it becomes the owner of the Pike's Peak Coal Company's reserves north of Colorado Springs. The company will begin at once the erection of a power plant on the site of the Park View coal mine. Power will be furnished for the mill at Colorado City, and it is planned by the company later to furnish light and power for this city. It is expected later to furnish coal for the Golden Cycle mine in the Cripple Creek district, and the company will make a bid for the coal for the big mines and mills of the district. Over $1,000,000 will be spent in the enterprise.

INTERURBAN LINE SOLD—The Rockford & Interurban Railway Company, Rockford, Ill., operating the local system and lines to Belvidere, Freeport and Janesville, has been sold to an eastern syndicate which owns a gas plant at Peoria, Ill., and the street railways of Springfield, Ill., Portland, Ore., and other cities. The change of ownership is to take effect July 1. Holders of preferred and common stock will receive par value for their shares. There is $50,000 preferred stock and $1,000,000 common. The new owners will take the entire property and assume the bonded indebtedness of $2,725,000. It is announced that the company has sold $1,000,000 of the capital stock to an eastern syndicate at par.

HYDROELECTRIC POWER IN MEXICO—Advices from Chihuahua, Mexico, state that representatives of the Mexican Northern Electric Power Company, a $10,000,000 corporation of Canada, organized to develop hydroelectric power in Northern Mexico, have been at Sta. Rosalia, negotiating for the purchase of the concession of Paul Ginther, of that place, and Joaquin Cortazar and Juan A. Creel, both of this city, for the right to build a great dam seventeen miles above Sta. Rosalia on the Conchos River to develop hydroelectric power and for a great irrigation project. It is claimed that a dam at that point will impound 1,840,000 cubic metres of water, that at least 24,000 horsepower can be developed to be transmitted to the great mining districts of Parral, Almoloya, Naica and Sta. Eulalia, and to various towns, including this city, and that the water impounded can be utilized to irrigate 150,000 acres more in the fertile Conchos River Valley than is now irrigated.

ELECTRIC-LIGHT MERGER—The International Gas and Electric Company, a western corporation, has absorbed the Citizens' Electric Light, Heat and Power Company, of Clifton Heights, Pa., and the Philadelphia Suburban Electric Company. These two corporations have been supplying nearly all of the boroughs and townships in Delaware County, Pa., with electric light. The Philadelphia Suburban Electric Company was formed four years ago by the late William L. Mathues, who was State Treasurer. This concern had absorbed the Farraday Heat, Light and Power Company, of Morton, and the Lansdowne Electric Light Company. Mathues had planned to buy the Clifton Heights plant and to build a large central plant, transmitting electric energy all over the county. The deal now consummated means, it is said, that a large central plant will be built and day and night current furnished. The price paid for the plants is not known. John A. Rigg, president of the Interstate Railways Company, was president of the Citizens' Electric Light Company, which position he has relinquished. It is also stated that the Media Electric Light Company will become part of the new merger, and that S. A. Dowling, superintendent of the Media plant, will be general manager of the merged concerns.

LIGHTING AND POWER.

(Special Correspondence.)

LITTLE ROCK, ARK.—This city contemplates issuing bonds for an electric-light plant.

RUSK, TEX.—The Rusk Light and Power Company has been incorporated with a capital stock of $3,500.

ARTESIA, N. M.—The Artesia Light and Power Company has been incorporated with a capital stock of $25,000.

EL DORADO SPRINGS, MO.—B. F. Proctor, of this city, has been granted a franchise for an electric-light plant.

TORONTO, CAN.—The Fountain Falls Electric Company has been incorporated with a capital of $1,000,000.

DENISON, TEX.—The Denison Light & Power Company has increased its capital stock from $125,000 to $200,000.

LAKE PRESTON, S. D.—The Lake Preston Milling Company has been granted a franchise for an electric-light plant.

CARTHAGE, N. M.—The Carthage Coal Company is planning the erection of a central power plant for surrounding points.

ALPINE, TEX.—The Alpine Power Company has been incorporated, with a capital stock of $30,000, to operate an electric-light plant.

LARAMIE, WYO.—Construction has been started on the large new hydroelectric light plant of the Southern Wyoming Power Company.

CHICAGO, ILL.—A certificate of increase in the capital stock of the Northern Illinois Gas and Electric Company from $2,500 to $600,000 has been filed with the county recorder.

PHILADELPHIA, PA.—More arc lights are to be placed in the streets, particularly in Walnut Street, and a general scheme of additional electric lighting is planned by the Electrical Bureau.

SALT LAKE, UTAH—The board of trustees of the Utah Agricultural College, Lorenzo M. Stohl, Salt Lake, president, has decided to erect an electric-light and power plant at the college at Logan, at a cost of $20,000. G.

STREATOR, ILL.—Streator has in prospect a $500,000 power, heat and light plant, to be built by Chicago capitalists. The new company is to furnish 80-cent gas, hot-water heat and cheap electrical power and light.

MILFORD, N. H.—The electric light and power plant here has recently been entirely rebuilt. It furnishes splendid service at Wilton and Amherst as well as in its own town. Five hundred horsepower is in use and nearly as much more is available.

ROANOKE, VA.—The Town Council of Honaker, Russell County, has drafted franchises for electric-light and water companies. The town is growing rapidly and many important industries, including a large lumber plant, are in course of construction.

NASHVILLE, TENN.—The A. & T. Power Company, White County, has been incorporated for the purpose of developing waterpower to manufacture electricity; capital stock, $10,000; incorporators, J. T. Anderson, O. H. Anderson, J. R. Tubb, S. B. Anderson and J. L. Nowlin.

DEFIANCE, OHIO—The city of Defiance will shortly advertise for bids for the street lighting of the city for the next ten years, and the water service. Negotiations are now pending with the Defiance Gas and Electric Company and the Defiance Water Company for new franchises and contracts.

GOUVERNEUR, N. Y.—The Hannawa Falls electric-light current is now in working order, but although many houses are wired waiting this connection no contracts are being signed by the company. It is stated that the Oswegatchie Light and Power Company is to control the Hannawa Falls company.

MT. MORRIS, ILL.—All the property of the Mt. Morris Electric Company has been sold to the Kane Brothers Company of Mt. Morris. The important thing in which the public is interested is the fact that the patrons of the electric company will be given all-night and all-day electric service, so that the current can be used for power as well as for light.

AURORA, ILL.—The electric-light illuminations here during the past week in honor of the G. A. R. Encampment attracted great enthusiasm. There was a gigantic electric arch on the island opposite the City Hall and the town was literally a blaze of lights. Every light, telephone and telegraph pole was wrapped with bunting. It was a most electrical gala affair.

HENDERSONVILLE, N. C.—The Green River Power Company, with head offices here, has been incorporated with a capital of $100,000. Power from the company's holdings on the Green River is to be carried by transmission lines to Hendersonville and throughout the county. A large cotton mill is also to be built by interests allied to the Green River company.

MARINETTE, WIS.—Beginning on June 1 and extending the length of the main street, one of the finest systems of street illumination will be installed, marking the inauguration of the Menomonie & Marinette Light and Traction Company's $1,000,000 power plant at Grand Rapids. Merchants have subscribed liberally for the system, and over 100,000 incandescent globes will be strung in arches fifty feet apart.

SANDPOINT, IDAHO—J. F. Reynaud, manager of the North Idaho and Montana Power Company, has decided to double the capacity of the company's plant at this place this summer, increasing the horsepower from 600 to 1,200. The present plant is to be replaced with a brick building at an approximate cost of $15,000. The company contemplates installing $30,000 worth of additional machinery.

NORTH ANDOVER, MASS.—Plans for a new power plant for W. T. Stevens & Sons Co. have been completed by Charles T. Main, mill engineer and architect of Boston. The plant is to consist of turbine-generator, boiler and pump rooms, with coal pocket in the rear. The walls are to be of brick. In the 25 by 50 feet turbine room will be installed a 360-kilowatt Westinghouse turbine generator with two exciters and a motor-driven Le Blanc condenser.

ST. GEORGE, UTAH—A. H. Ensign is president, George Z. Edwards vice-president, R. J. Evans secretary and treasurer and B. E. Slusser manager of the newly-organized St. George Electric Company, with headquarters at 207 D. F. Walker Building, Salt Lake City, Utah. The company has secured a twenty-five-year franchise for furnishing light and power in the city of St. George. Construction work is to be started immediately.

SANTA FE, N. M.—The $450,000 power project on the upper Pecos, twenty miles east of Santa Fe, has received the approval of Territorial Engineer Sullivan. The plant is to generate 4,500 horsepower to supply Santa Fe, Las Vegas and Albuquerque, with power. The water will be taken out of the Pecos River and its tributaries, and 120 cubic second-feet are appropriated for the purpose. The applicant is Ernest H. Fischer of Cimarron, and in addition to cement-lined ditches, a five-foot pipe line six miles long will be laid.

MACKAY, IDAHO—The Mackay Light and Power Company has been formed as an incorporation, with a capital stock of $25,000. J. H. Greene, J. D. Daniels, J. C. Davidson and Henry Diers are the directors. The company will erect a power and light plant, and has filed on sufficient water on Big Lost River to generate four or five hundred horsepower. Surveys for ditches, power house, etc., have been made. Two members of the company have received a franchise from the city for the construction of an electric street-railway line here.

SPRINGFIELD, OHIO—The Springfield Light, Heat and Power Company have awarded the contract for a 2,700-horsepower steam turbine and generator to the General Electric Company of Schenectady, N. Y. As soon as the plans and specifications for the new building are completed, in about two weeks, bids will be called for and the contract will be awarded as quickly as possible. The building and equipment will cost about $200,000. It will be modern throughout and practically fireproof. There will be installed an overhead crane for the handling of all heavy machinery.

PORTLAND, ORE.—The rumor that the Oregon Light and Power Company of Portland, Ore., which was incorporated early this month with a capitalization of $2,000,000, is backed by the Swifts of Chicago, has created a good deal of interest in construction circles. The officers of the company declare they intend to operate in Portland, Seattle and Tacoma. Over $50,000 has already been expended in a sawmill to manufacture wood for flumes and in the purchase of water rights. The company holds rights on the Cowlitz River alone which could generate, it is declared, 40,000 horsepower.

RENO, NEV.—Articles of incorporation of the Lander County Power and Light Company have been filed here, capitalized at $200,000. The company is organized to construct and operate electric-light and power plants and telephone and telegraph lines through Nevada. E. L. LaBadie, Julius Beeman and E. J. Knox, all of Reno, are the incorporators. Nevada is absorbing every volt of power its plants can generate, and several hundred thousand dollars will be spent this year on different electrical projects throughout the state. The Nevada-California Power Company has commenced work on what will be the largest dam in the state. The structure is intended to dam up the waters of South Lake, raise the level seventy-five feet above the old level, and increase the surface of the lake to more than twice its present area. The dam will be six hundred feet long and seventy-five feet high. The Nevada-California Company has accepted plans for several long extensions of its lines this year, one particularly from Millers to Manhattan. This line will tap one of the most prosperous of the Nevada districts that have hitherto been without power.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SPRINGFIELD, OHIO—A company has been formed with $10,000 nominal capital to build an electric line from Urbana to Columbus, going through Plain City and Mechanicsburg.

PHILADELPHIA, PA.—At the conclusion of the meeting of the Interstate Railways bondholders' committee, it was announced that no action was taken and the committee adjourned to a later date.

ALTOONA, PA.—Judge James M. Shull, of Perry County, has granted a temporary injunction restraining Attorney-General Hampton Todd or any of his deputies from selling the franchise and property of the Altoona & Beech Creek Railroad for $1,357.19 of unpaid taxes. W. S. Lee, W. J. Heinsling and Andrew Kipple, who obtained the injunction, asked that a receiver be appointed for the company.

RICHMOND, VA.—At the receivership sale the various city railway properties were bought in by the Bond Committee representing the Gould interests for $8,100,000. The sale was at auction under decree of court.

NEW YORK CITY, N. Y.—Judge Lacombe has extended the time for taking testimony in the foreclosure proceedings brought by the Guaranty Trust Company against the Second Avenue Railroad until August 9.

COVINGTON, IND.—The proposed electric railroad from Covington through Coal Creek, Cates, Kingman, Wallace, Alamo to Crawfordsville is now assured. The money has been subscribed and the power house will be built in Covington.

WESTCHESTER, PA.—The charter of the Christiana & Coatesville Street Railway Company has been received at the Recorder's office, in Lancaster. The capital stock is $400,000, divided into 8,000 shares of the par value of $50.

WARREN, OHIO—The Mahoning Valley Railway Company now has authorized the extension of its electric line system so as to reach the Ohio Works plant in Youngstown, an improvement that that city has been demanding for several years past.

UVALDE, TEX.—The Uvalde & Crystal City Railway is to be built. The $50,000 bonus and right-of-way were accepted by the promoters and the contract signed. Work will be commenced at once and the road completed and in operation by January 1, 1910.

BROOKLYN, N. Y.—The New York Court of Appeals has decided in favor of the Brooklyn Rapid Transit Company on the proposed extension of the Nostrand Avenue trolley line one-and-one-half miles, for which Borough President Coler refused permission.

NEW YORK CITY, N. Y.—The Board of Estimate of New York city has referred the proposed extension of the McAdoo tubes to the Grand Central station to the Committee on Franchise. There was no opposition against the extension, but some developed against location of certain stations.

OTTAWA, ILL.—Work is being pushed on all the new lines of the interurban system, and it is stated cars will be running between Streator and Grand Ridge by June 1. Work has been started on the Tampico-Hooppole line and also on all the McKinley Company's interurban lines in Streator.

IOLA, KAN.—There is to be a lot of electric railway building in Kansas this and next year, and according to authorities on the subject Iola is to be the center of the Southeastern Kansas systems. All towns in this section of the state claim they will be the center, but Iola is to be the "hub," it is said.

FT. WAYNE, IND.—The new electric line from Ft. Wayne to Defiance, Ohio, has been financed and construction work will be started right away. The arrangement includes the purchase and rebuilding of the present electric line in Defiance. Bonds amounting to $1,200,000 have been underwritten in Chicago.

FORT WAYNE, IND.—Ten new cars for the Fort Wayne city system, a new power house at Lafayette, and some additional interurban equipment, but no extension whatever of the interurban system, summarizes the plans of the Fort Wayne and Wabash Valley Traction Company for the immediate future.

COATESVILLE, PA.—The Christian & Coatesville Trolley Company has secured the last right-of-way for the road between Christiana and Parkesburg. Work will be rapidly pushed and the expectation is that the line will be completed by July 4, when there will be through service from Lancaster to Philadelphia.

PEORIA, ILL.—Work has been started on the electric line between Galesburg and Peoria. All the towns between this city and Galesburg have either granted the company a franchise, or will do so in the near future. The chief work now is on the right-of-way from Peoria to Knoxville. The route so far has been practically determined upon, although not exactly laid out as yet.

EVANSVILLE, IND.—The extension of the Rockport traction line to Grandview is an immediate probability. The E. & E. line now has $200,000 in bonds in the treasury to be issued for extensions. It is probable that these securities will be placed on the market to provide funds for the building of the Grandview line. The township through which the road will pass has already voted a two per cent subsidy.

MOLINE, ILL.—The project for which the Tri-Cities and Northeastern Railway Company has been organized, namely, the building of an interurban line from Watertown to Albany, is of importance to Moline. By reason of the benefit which will accrue from being placed in direct communication with the villages which line the Illinois shore of the Mississippi, the Tri-City and Northeastern has already made arrangements by which its cars will be run into Moline, so that when the line is completed Moline will supersede Davenport as the city most accessible for those up-country folk.

GREENVILLE, S. C.—The City Council has granted a franchise to the Paris Mountain trolley line, which road is projected to run to Altamont peak or thereabout. For the construction of this line Greenville people have subscribed a bonus of $30,000 to be given a company of Chicago capitalists who have agreed to build the road. The agreement is that the work of construction shall commence within ninety days.

COLUMBIA, MO.—The Mexico, Santa Fe and Perry Traction Company, of Missouri, is busy procuring the franchises for its tracks through the various cities the line passes through. The company has nearly twelve miles of city trackage on the 108 miles of line already arranged for. In Hannibal there is three-and-one-half miles; New London, one mile; Center, one mile; Perry, one-half mile; Mexico, two miles; Columbia, two miles, and Fulton, one-and-one-half miles.

ESCANABA, MICH.—It is stated that the Escanaba Street Railway Company will extend its line from Escanaba and Wells to Rapid River, at the head of Little Bay de Noquette, passing through the city of Gladstone en route. P. L. Utley, of Watertown, Wis., and associated capitalists have recently acquired important stock holdings in the street railway company, and it is due to the entry of the new interest that the traction expansion is projected. Mr. Utley and his associates control the Escanaba Power Company, which has developed a waterpower on the Escanaba River and is supplying electrical power to both the city of Escanaba and Gladstone.

PLATTSBURG, N. Y.—It is reported that work on the electric railway from Fair Haven to Poultney, Middletown, Grandville, Wells and Paulet will be started July 1. Franchises have been granted, and it is said the new corporation has $1,000,000 capital. President Hainz, of the Coney Island Street Railway Company, is president of the new corporation, and others interested in the project are W. Nathaniel, of Poultney, A. Mulholland, of New York, and A. Y. Gray, of Middletown. The company was granted a charter by the Vermont Legislature two years ago. The source of the necessary electric power will probably be at Poultney, using the Mettowee River.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

DUBUQUE, IA.—The Bell Telephone Company has bought the Independent Standard Telephone Company, of Northwestern Iowa.

PIQUA, OHIO—The loss on the recent fire at the Piqua Home Telephone Company's plant is estimated at $40,000. Local telephone service will not be resumed until the plant is rebuilt.

TROY, N. Y.—The People's Protective Telephone Supply Company of Troy, capital $10,000, having been organized to deal in telephone appliances, has been incorporated with the Secretary of State.

JERSEY CITY, N. J.—Alabama & Tennessee Telephone and Telegraph Company has been incorporated; capital, $200,000; incorporators, George A. Berger, George B. Fielder and Frederick W. Schaeffer.

RIVERSIDE, CAL.—Plans are under way by the Pacific Telephone and Telegraph Company for a handsome mission building to house the central exchange, to cost $12,000 to $15,000. The location has not been definitely decided on.

AUGUSTA, ME.—The Milo, LaGrange & Alton Telephone Company has been organized at LaGrange, for the purpose of constructing and maintaining telephone lines in the towns of LaGrange and Alton in Penobscot County and Medford in Piscataquis County with $5,000 capital. President, P. E. Speed of LaGrange; treasurer, W. B. Hunter of LaGrange.

HUTCHINSON, KAN.—The May issue of the Missouri & Kansas (Bell) Telephone Company's directory has been delivered to subscribers. It contains the names of 225 odd new subscribers added since the January issue. The business of the telephone company, it is said, has shown a healthy growth every month, in spite of the financial conditions which have prevailed.

ROCKFORD, ILL.—Additional connections with the local exchange of the Home Telephone Company are being planned, and in a short time Belvidere will be directly connected with Rockford. The Belvidere company is extending its line from that city to Cherry Valley and from the latter place will be able to connect direct with Rockford, and from this city with the other exchanges in this part of the state on the independent circuit.

CHICAGO, ILL.—The Chicago Telephone Company will not close the Illinois Tunnel deal unless the City Council waives the demand for connections with the independent companies in towns where the Bell company is located. President McRoberts says that the city must decide immediately, and if it refuses to consent to the sale of their telephone plant, they will start immediately installing the 20,000 automatic telephones, required in their franchise, before October.

BOONE, IA.—Contracts have been let to W. J. Zitterell, of Webster City, for the erection of a new building for the Boone County Telephone Company, the work to start immediately and be completed September 15. The building is to be three stories high and absolutely fireproof, with concrete floors, steel doors, wire-glass windows and concrete roof. All inflammable material is to be eliminated. An entire new plant is to be installed this year costing the stockholders $125,000.

BOSTON, MASS.—Representative Martin L. Quinn of Swampscott has taken the initiative in the fight for lower telephone rates in the town of Swampscott and between that town and Lynn. If the New England Telephone and Telegraph Company does not voluntarily reduce or readjust its schedule of rates of which he and its subscribers complain, Mr. Quinn declares he will take the matter to the Massachusetts Highway Commission which has supervision of this branch of the public service, through a petition asking for hearings on the subject.

CLEVELAND, OHIO—McLoud & Pulliam and Otis & Hough have taken possession of the $475,200 collateral notes of the Cuyahoga Telephone Company and the telephone company received the money for the new security. The notes were purchased largely by banks at different places in Northeastern Ohio. Coincident with the closing of this transaction, it is announced also, that every cent of the floating debt of the Cuyahoga Telephone Company was paid at once out of the proceeds of this issue. The remainder is to be put into improvements.

BRIDGEHAMPTON, N. Y.—An attempt is being made to form an independent telephone company in Bridgehampton. It is estimated that eighteen miles of lines would be required to cover the territory of about sixteen square miles embraced in the village limits, taking in not only the business part of the village in Sag Harbor, but also Sagaponack, Mecox, Hay Ground, North District, Poxabogue and all other sections. This would give a valuable local service, which is now lacking. The lines of the New York and New Jersey Telephone Company tap the business places and residences along Main Street, but do not extend out into the surrounding territory.

NEW PUBLICATIONS.

RESULTS OF PURCHASING COAL UNDER GOVERNMENT SPECIFICATIONS—A report on the results of purchasing coal under the government specifications, by J. S. Burrows, has just been published by the Geological Survey as Bulletin 378, which contains also a brief paper by D. T. Randall on burning the small sizes of anthracite for heating and power purposes. Copies of this bulletin, which is now ready for distribution, may be obtained by applying to The Director, United States Geological Survey, Washington, D. C. The series of tables given at the end of the booklet and showing tabulated results are decidedly instructive.

ELECTRIC TALKS—The Buffalo General Electric Company has issued an interesting book containing thirty one-page articles, and entitled "Electric Talks." The purport of the book is primarily to instruct the citizens of Buffalo, N. Y., in the subject of utilization of electricity in a practical yet nontechnical manner. After a careful perusal of the book the reader will readily understand some of the mysteries of electric generation at a distance, its transmission, and its utilization to operate a modern power plant. Meters and load curves are elucidated, and the effect of load variation on prices is clearly shown. In this connection the "readiness-to-serve" charge is ably explained. Comparisons of charges are made with those of other cities, with figures that are certainly flattering to Buffalo. The electrical advantages of this city being thus demonstrated, a plea to boost Buffalo by spreading the truth of these advantages winds up the book. The central-station man, no less than the citizen of Buffalo, will find many things of interest in this publication.

EDISON ROUND TABLE—The second number of this publication, issued by the Commonwealth Edison branch of the National Electric Light Association, made its appearance at the beginning of last week and is even better than the first. It gives all manner of interesting information in regard to the workaday life of central-station men. It tells quite frankly what they have to contend with and how they meet their difficulties. There is a question box where questions are put and answered by well-known members of this branch of the Association. Any employe of the company is welcome, nay is asked, to make suggestions.

An account of a new employment bureau gives valuable data to those who want to know how to get into the service of this central-station company. There are also many personals concerning well-known department men or men who have prospered since leaving the company's service. In make-up, general appearance, illustrations and the like, it is a credit to R. F. Schuchardt and Dana H. Howard, who really look after nearly all the detail work. Mr. Howard has a right to be proud of his "bantling," which seems destined to grow into a very sturdy chick.

PERSONAL MENTION.

ROBERT MATHER, chairman of the executive committee of the Westinghouse Electric and Manufacturing Company, has returned from Europe after a two months' trip. Part of the time Mr. Mather traveled with George Westinghouse and visited the various foreign plants of the company.

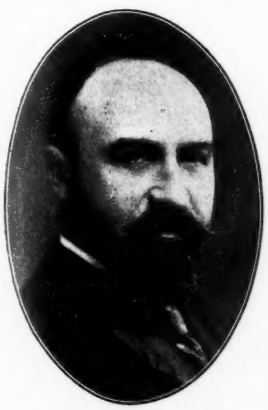
CARL S. DOW, S.B., engineering department, Harvard University, and lately publicity manager for the B. F. Sturtevant Company, has joined the staff of Walter B. Snow, the well-known publicity engineer of Boston. Mr. Dow has been very successful in all lines of technical publicity.

LEVERETT S. MILLER, general manager of the Central New England Railway Company, has resigned to accept the presidency of the Millbrook Company. The Millbrook Company is a holding company for the Mount Vernon & Eastern Railroad Company, the New York, Westchester & Boston Railroad Company, the New York & Portchester Railroad Company, and the County Contracting Company. He will have headquarters in New York city.

DWIGHT T. RANDALL, M.E., member of the American Society of Mechanical Engineers, late engineer in charge of fuel tests, Technologic Branch, United States Geological Survey, has associated himself with the Arthur D. Little Laboratory of Engineering Chemistry of Boston, in charge of the Department of Fuel Engineering. Mr. Randall, who is a graduate of the University of Illinois, was formerly connected with R. W. Hunt & Company, and Westinghouse, Church, Kerr & Company, and later was in charge of the Steam Engineering Laboratory of the University of Illinois, and of the Steam and Boiler Tests at the St. Louis Exposition.

FRANK L. PERRY will deliver an illustrated address on the subject of the Wright aeroplane and its use as a possible base for the operation of wireless telegraphy before the Lewis Institute branch of the American Institute of Electrical Engineers on Wednesday evening, May 26. The lecture will be held in the Lewis Institute Auditorium. Mr. Perry and Professor Woodworth of Lewis Institute are negotiating for the use of, and it is expected that they will be able to present, a moving-picture film showing the remarkable flights of Wilbur Wright in France. This film gives a vivid eighteen to twenty-minute record of Mr. Wright's experiments in aviation.

DR. LEO HENDRIK BAEKELAND, who has just been elected president of the American Electrochemical Society, is well known as a research chemist and chemical expert of international experience. He is Flemish by birth, but has been a resident of this country for some twenty years. He was formerly Associate Professor of Chemistry at the University of Ghent and Professor at the Higher Normal School of Bruges. As the result of his research work, on which he has written many papers, he invented the well-known Velox paper and the so-called gaslight printing papers so extensively used in photography, also many improvements in the electrolytic manufacture of caustic soda and chloride of lime. His latest research work has been the development of "Bakelite." On his property at "Snug Rock," in the wooded outskirts of Yonkers and overlooking the Hudson, is located his excellently equipped research laboratory, where so much of his recent work has been carried out. Aside from his chemical studies, Doctor Baekeland had also published some philosophical essays and a book on travel. Among other positions of honor that he now holds are the vice-presidency of the American Chemical Society and chairmanship of its New York section, also the vice-presidency of the Society of Chemical Industry; he is a past-president of the Chemists' Club. Doctor Baekeland has just sailed for a sojourn in Europe, and will represent the United States at the International Congress of Applied Chemistry.



OBITUARY.

BRADFORD SHINKLE, vice-president of the Hemingray Glass Company, Covington, Ky., died on May 7.

FRANK H. CHAMPLIN died recently at his home in Laconia, N. H. To him belonged the credit of having organized the first telephone company in Laconia, the Winnipesaukee Bell Telephone Company, which covered quite an extensive territory. He was manager until that company was absorbed by the New England Telephone and Telegraph Company.

ELECTRICAL SECURITIES.

The continued development of confidence in projected business improvement is the one satisfactory feature of stock market doings at the present time. Tone is upward, if anything, but there has been a halt in the enthusiastic following by the public of the tip to buy for the future. This is just as well, for in many quarters it is expected that there has been some discounting, and a pause now will allow real values to catch up and establish less opportunity for disappointment and less chance for overstraining.

Dividends have been declared upon the following electrical securities: Kings County Electric Light and Power Company; the regular quarterly dividend of two per cent, payable June 1. St. Joseph Railway, Light, Heat and Power Company; the regular quarterly dividend of one-half of one per cent on the common stock, payable June 1 to stock of record May 15. Philadelphia Electric Company; the regular semi-annual dividend of three per cent, payable June 15 to stock of record May 25. (The directors have decided that hereafter dividends will be paid quarterly instead of semi-annually). Butte Electric and Power Company; the regular quarterly dividend of one-and-one-half per cent on the common stock, payable July 1 to stock of record June 15. Brooklyn Rapid Transit Company; the regular quarterly dividend of one per cent, payable July 1, as recommended by the executive committee, to stock of record June 9. Chicago Telephone Company; the regular quarterly dividend of two per cent, payable June 30. American Railways Company; the regular quarterly dividend of one-and-one-half per cent, payable June 15 to stock of record May 31. Grand Rapids Railway Company; the regular quarterly dividend of one per cent on the common stock, payable June 1 to stock of record May 15.

ELECTRICAL SECURITIES FOR THE WEEK ENDED MAY 15.

New York:	*Closing.*
Allis-Chalmers common	16⅛
Allis-Chalmers preferred	50⅜
American Tel. & Tel. Company	140
Brooklyn Rapid Transit	79⅝
General Electric	159
Interborough-Metropolitan common	16⅜
Interborough-Metropolitan preferred	45¾
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cable) common	79½
Mackay Companies (Postal Telegraph and Cable) preferred	73⅝
Manhattan Elevated	146½
Metropolitan Street Railway	27
New York and New Jersey Telephone	110
Western Union	75
Westinghouse Manufacturing Company	83

The annual meeting of the stockholders of the General Electric Company, held in Schenectady, N. Y., on May 12, has resulted in re-election of the retiring directors.

At the annual meeting of the Interborough Rapid Transit Company, August Belmont, E. J. Berwind, James Jordan, Morton F. Plant and Cornelius Vanderbilt were re-elected directors.

Transactions in the first mortgage five per cent bonds of the Allis-Chalmers Company are now running at the rate of about $500,000 per week, giving to that issue a place of rather unusual prominence among the listed industrial bonds. In connection with this activity, moreover, it is of interest to note that the bonds are selling at an advance of about three points from the highest price reached since their listing on the Stock Exchange.

Gross earnings of the Brooklyn Rapid Transit Company have increased during May, at the rate of $3,000 to $5,000 per day, and there is no question now but that the company will be able to close its fiscal year with gross earnings in excess of a year ago. Net earnings will show between four and five per cent for the stock. The Brooklyn Transit Company is now financed for the balance of this year, and it is not planned to sell any bonds. It has $3,000,000 cash in the bank and owes about $3,500,000.

Boston:	*Closing.*
Edison Electric Illuminating	—
Massachusetts Electric	70½
New England Telephone	132¾
Western Telephone and Telegraph pref.	87

R. L. Day & Co. will sell at auction on Wednesday, May 26, 1,501 shares of Boston Elevated Railway stock.

Philadelphia:	*Closing.*
Electric Company of America	12⅜
Electric Storage Battery common	48½
Electric Storage Battery preferred	48½
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	34½
United Gas Improvement	85¾
Chicago:	*Closing.*
Chicago Telephone	132½
Commonwealth Edison	117½
Metropolitan Elevated preferred	51
National Carbon common	85
National Carbon preferred	119

INDUSTRIAL ITEMS.

I. P. FRINK, 551 Pearl Street, New York, N. Y., announces that W. A. Purcell has been appointed San Francisco agent for the general line of Frink reflectors.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., describes and illustrates its central-station transformers in Bulletin No. 86. A copy of this bulletin will be sent to those interested upon request.

THE CHARLES L. KIEWERT COMPANY of New York has been incorporated with offices at 39 Cortlandt Street, New York city. W. F. Hessel is manager. "Alba" and "Aurola" flaming arc lamps will be the principal lines.

JAMES BEGGS AND COMPANY, of New York, manufacturers of the Blackburn-Smith feed-water filter and grease extractor, have appointed numerous competent sales agents in various important cities in the United States and Canada and abroad.

THE S. MORGAN SMITH COMPANY, York, Pa., has opened an office in Chicago at 644 American Trust Building. J. C. Temple, an expert hydraulic engineer, has charge of this office and will be pleased to hear from people west of Pittsburg who are contemplating installing turbine wheels.

THE RAUCH & LANG CARRIAGE COMPANY, Cleveland, Ohio, have issued their 1909 catalogue of electric carriages. This catalogue is a veritable triumph of the printer's art and contains descriptions, specifications, and halftones of the various electric carriages manufactured by the company.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing a very interesting folder entitled, "It's a Snap." This folder calls attention to the very successful use of National metal molding for inside work. There is also some literature showing typical installations which demonstrate the utility and flexibility of this system.

THE HOLOPHANE COMPANY, New York, N. Y., had a most instructive article on the "Lighting of a General Office" in its April issue of its very bright publication "Holophane Illumination." By illustrations of the company's own offices lighted by this system a very good idea of the effect produced is obtained. The matter of fixtures, globes and reflectors is also very pertinently expressed.

THE GENERAL ELECTRIC COMPANY has issued Bulletin No. 4659, in which are described some switchboard instruments for use on alternating-current circuits, and constructed on the induction principle. Ammeters, voltmeters and wattmeters are made in this type of instrument, and are constructed so as to be uninfluenced by stray fields. Indications of the pointer are rendered "dead beat" and the scale extends through an arc of 300 degrees and is practically uniform throughout. This Bulletin contains catalogue numbers, prices and dimensions of this instrument.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., calls particular attention to the following bulletins just put out—No. 1112, on Type D C P. enclosed direct-current arc lamps, Form C, for operation on power circuits; No. 1115, on single-phase integrating induction wattmeters; No. 1116, on Type DCM enclosed direct-current multiple arc lamps. All are handsomely illustrated and complete in technical detail. The company is the well-known manufacturer of the "Wood" systems, and any pamphlet sent out by its publication department is worthy the closest attention.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has recently made the following sales of comparatively large units: One 300-kilowatt 250-volt direct-current generator to the Perry Fay Manufacturing Company, Elyria, Ohio; a similar machine of 300 kilowatts, 125 volts, to the Cleveland Provision Company, Cleveland, Ohio. Also direct-current motors aggregating 235 horsepower to the Spanish-American Iron Company, Felton, Nipe Bay, Cuba; similar motors totaling 135 horsepower to the Morgan Engineering Company, Alliance, Ohio. These are in addition to numerous other smaller orders.

THE WEST ALLIS WORKS OF THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., report great activity in the gas-engine-building line, as a result of recent orders crowding close upon others received since the first of the year, the units of which are now being assembled for shipment. Among the orders just booked are three gas engines, aggregating 1,000 horsepower, direct-connected to three Allis-Chalmers electric generators, for the Palmetto Phosphate Company, Tiger Bay, Fla.; a gas engine of approximately the same size, with generator, for the Armstrong Cork Company's plant at Camden, N. J., and a 1,500-kilowatt gas-driven electric unit and seven-standard, 30,000-cubic-foot gas-driven blowing engines for various blast furnace plants.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has brought out a neat little booklet on "Valuable Graphite Products." It is really a pocket edition general catalogue, in which the company lists its principal products, such as crucibles, facings, lubricating graphite, greases, pencils, protective paint, with brief descriptions and prices. It is of value to the purchasing agent, engineer, contractor, superintendent, and anyone, in fact, who uses or specifies graphite in any form. The booklet is of commercial envelope size, and will conveniently go in the pocket or desk pigeonhole. It is substantially bound in tough cover stock, and attractively printed. A copy may be obtained by addressing the Joseph Dixon Crucible Company at their home office, Jersey City, N. J.

THE LORD ELECTRIC COMPANY, New York, has issued Bulletin F describing the "controlator," which is a simple mechanical device for use as a controller regulator to insure uniform acceleration in applying current to the motors. It is claimed that the controlator effects a saving of at least twenty per cent of the current used by the average motorman, and that it cuts down the peak loads from forty to sixty per cent, besides preventing undue sparking, burnouts, and blowouts. The same company has also issued Bulletin J describing Garton's Multi-Vapo-Gap lightning arresters which are designed especially for the protection of signal systems. In these arresters the feature is the mechanical formation of a vapor cloud which forms a perfect static conductor of absolute uniformity while effectively preventing the passage of the normal working current.

THE HOLOPHANE COMPANY, of New York, has moved its general offices, with the headquarters of the sales and engineering departments, to Newark, Ohio, where the Holophane Glass is manufactured. The business of the company has been handled up till now from New York city, but in the interests of prompter shipments and to better serve the steadily increasing market, the concentration of the entire organization was deemed advisable. The branch offices of the sales department, located in New York, San Francisco, Boston and Chicago, however, will continue as before. It is an interesting indication of Holophane system that only one working day was lost between the cessation of the business in New York and the opening in Newark. Practically the only inconvenience experienced by customers was due to delay caused by mail being misdirected to New York after the closing of the old office.

THE D'OLIER ENGINEERING COMPANY, Philadelphia, Pa., has been awarded the contract from the United States Government for a complete hydroelectric plant at Fort Yellowstone, for furnishing light and power throughout Yellowstone National Park. This will include a concrete power house and a twenty-six-inch steel penstock, the latter about 2,200 feet long. The machinery includes three 150-kilowatt, alternating-current, three-phase, sixty-cycle generators, each direct-connected to one 280-horsepower D'Olier Francis turbine operating under a head of about 275 feet. A complete switchboard of the most modern type and transmission wiring are also included in the contract. The D'Olier Company is also installing at the Norfolk and Charleston navy yards fifteen-inch vertical volute pumps in the dry-dock caissons to replace pumps recently purchased from other firms but which failed to develop the capacity required.

DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual convention, Canton, Ohio, May 21-22.

American Association of Electric Motor Manufacturers. Annual convention, Hot Springs, Va., May 24-27.

West Virginia Independent Telephone Association. Annual convention, Parkersburg, W. Va., May 27-28.

National Electric Light Association. Annual convention, Atlantic City, N. J., June 1-4.

Association of Edison Purchasing Agents. Annual convention, Atlantic City, N. J., June 1-4.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 16-18.

Canadian Electrical Association. Annual convention, Quebec, Canada, June 16-18.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 21-23.

Association of Railway Telegraph Superintendents. Next meeting, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 18-22.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) May 11, 1909.

920,898. INDUCTION MOTOR. Theodore Abtmeyer, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed July 13, 1907. The rotor has tubular conductors angularly disposed with reference to its axis.

920,906. ELECTRIC COOKING VESSEL. Friedrich Bölling, Frankfort-on-the-Main, Germany, assignor to the Prometheus Electric Company, New York, N. Y. Filed November 5, 1908. The vessel contains a resistance, a metallic ring insulated therefrom and adapted to press it against the wall of the vessel, and a contact box soldered to the wall of the vessel and provided with contact pins adapted to conduct current to the resistance.

920,915. ELECTRIC-LIGHT HANGER. Harry G. Cleveland, Plymouth, Conn. Filed June 12, 1908. In the base is a spring-actuated rotary drum, with a cord-controlled brake acting on its flange.

920,918. CAR-VENTILATING SYSTEM. Dwight I. Cooke, Chicago, Ill. Filed December 18, 1908. There is an electrically-operated exhaust fan for drawing off the air within the car body, and an electric controlling regulator under the control of the car men at all times for regulating the speed of the fan.

920,920. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Frederick W. Cox, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 4, 1906. Has two pairs of clamping rings bolted together, the intermediate pair engaging the lower central portions of the segments independently of the outer clamping rings, though secured by the same bolts.

920,925. VOLTAGE-REGULATOR. Frederick Darlington, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 3, 1906. In combination with a transformer having juxtaposed windings arranged in parallel is a motor for making connections alternately through the respective windings.

920,926. MOVABLE TERMINAL FOR VOLTAGE-REGULATORS. Frederick Darlington, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 3, 1906. A contact terminal for the above comprises a number of rings or wheels of different diameters and a shaft upon which the wheels are yieldingly but non-rotatively mounted.

920,927. INDICATING MEANS FOR INSTRUMENTS. Harry P. Davis and Paul MacGahan, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed October 21, 1905. An incandescent lamp is mounted on the movable indicator of a synchroscope.

920,932. ELECTRIC SIGNAL APPARATUS. Charles E. Duffie, Omaha, Neb. Filed April 27, 1907. Has circuits comprising one each of the two coils of a differential relay, a signal device controlled by the relay, a signal circuit with a contact circuit controlled by it, and means for including the contact circuit in one of the differential relay circuits.

920,938. CONCENTRATING DEVICE FOR TELEPHONE TRANSMITTERS. Oscar F. Falk, Belleville, N. J., assignor to American Telephone and Telegraph Company. Filed August 21, 1908. The concentrator has a parabolic wall with an opening near its center and a frusto-conical tube with its larger end filling this opening, and its smaller end directed toward the transmitting unit.

920,940. MACHINE FOR COMBINING AN ADDING-MACHINE AND TYPEWRITER. Henry M. Ferry, Detroit, Mich. Filed June 4, 1907. Is an electromagnetic device for detachably coupling an adding machine and a typewriter to cause the automatic operation of the printing keys of the typewriter by the corresponding keys of the adding-machine.

920,965. OZONE-PRODUCER. Samuel M. Kintner, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 28, 1905. Has in combination with a source of alternating or pulsating current a condenser, a discharge gap having one or more pointed terminals, and a discharge gap having blunt terminals all arranged in series circuit relation, and means for adjusting the widths of the gaps.

920,966. TELAUTOGRAPH. Anton M. Knudsen, Chicago, Ill., and Karsten Knudsen, Grand Rapids, Mich. Filed March 12, 1906. Has a transmitter with three impedance units of a variable inductance, a receiver having electromagnets corresponding to these, and means for varying the inductance of the impedance units.

920,970. FOILED PAPER AND METHOD OF PRODUCING SAME. George F. Mansbridge, Sanderstead, England. Filed January 13, 1906. A sheet of paper is coated with a thin film of powdered metal for electrical purposes, having the defective places in the paper isolated from the metal or foil.

921,013. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed April 8, 1907. Has an electric circuit closed between terminals separated in an electrolytic liquid, a high-frequency circuit associated with a radiating conductor, and including these terminals and liquid.

921,018. ELECTRICAL APPARATUS. Herbert C. Soule, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed August 3, 1907. Is a transformer enclosed in a removable fluid-containing casing, and having a magnetizable core member, a winding and means for suspending the core member from an overhead support.

921,025. OVERHEAD TROLLEY. John C. Sturgeon, Erie, Pa. Filed January 29, 1908. A built-up trolley has a peripherally-curved copper contact ring secured between the circumferential flanges.

921,038. CEILING-ROSETTE FOR DROP ELECTRIC LAMPS. William Wilbraham, Chicago, Ill. Filed July 14, 1908. Consists of a single piece of insulating material having a marginal rim to bear against the ceiling, and an axial screw-receiving passage, at the bottom of which is a deep countersink, into which enters laterally a passage for an electrical conductor.

921,046. CIRCUIT-INTERRUPTER. James M. Wilson, Meriden, Conn., assignor to the Connecticut Telephone and Electric Company, Meriden, Conn. Filed June 16, 1908. Has two contacts, one actuated by a normally-retracted movable magnetic member, controlled by field magnet and armature, and engaging the other when movable member is retracted.

921,050. SNAP-SWITCH. James H. Wyatt, Philadelphia, Pa., assignor to William M. Scott, Philadelphia, Pa. Filed October 22, 1908. Has an operating spring, a spring-winding member, and a detent engaging and rotating with a contact-carrying member.

921,053. TERMINAL STRUCTURE FOR ELECTRICAL APPARATUS. John H. Zimmermann, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 4, 1905. An instrument casing has a terminal casing extension provided with a detachable front wall and openings in its top wall, terminal members, and means for supporting and insulating the same.

921,054. MAGNET-SUPPORT FOR ELECTRICAL MEASURING INSTRUMENTS. John H. Zimmermann, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 4, 1905. A bracket is attached by binding screws to a strip engaging with lateral recesses in the instrument frame, and supported thereby are damping magnets relatively fixed and adjustable in a plane parallel to the plane of rotation of a disk mounted in the air gaps of the magnets.

921,060. ANNUNCIATOR. John H. Ballweg, Baker City, Ore., assignor of one-half to J. Ballweg, Baker City, Ore. Filed June 18, 1908. Has a casing having a display opening, a revolubly-mounted operating shaft and means for driving it, a drum with indicating characters on it mounted loosely on the shaft, and operatively connected to it by a clutch actuated by a solenoid.

921,061. CONDUIT. Eugene L. Barnes, Detroit, Mich. Filed March 16, 1908. A heat-insulating conduit is formed of sections sleeved upon the inner conduit to be protected, coupling members for these sections, and roller bearings in the coupling members for mechanically supporting the inner conduit.

921,075. MAST FOR SPACE OR WIRELESS TELEGRAPHY. Alexander E. Brown, Cleveland, Ohio, assignor to the Brown Hoisting Machinery Company, Cleveland, Ohio. Filed August 3, 1906. Describes a method of building up an insulating portion or section of a supporting base for a mast for space or wireless telegraphy.

921,108. MAGNETIC ELECTRIC-LIGHT HOLDER. David J. Hauss, Aurora, Ind. Filed February 20, 1908. Has means for detachably connecting an electric light to a magnetic holder.

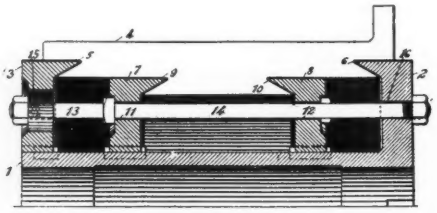
921,116. SELECTIVE SIGNALING SYSTEM. Arthur W. Jones, Schenectady, N. Y., assignor to General Electric Company. Filed May 8, 1906. There are electromagnets at the receiving stations connected to the line and normally locking the signal devices at the receiving stations in clear position, and means whereby these devices may be selectively unlocked from the sending station.

921,119. TELEPHONE. Adolph G. Kaufman and Leopold J. Lippmann, New York, N. Y., assignors to American Callaphone Company. Filed November 13, 1906. Has switches individual to the transmitter circuits and capable of being operated singly or together, one or more receivers in and individual to each transmitter circuit, and a common conductor leading from the battery or other source of current to the receiver circuits, the other conductor leading from the battery to the several line terminals.

921,141. SOUND TRANSMITTER AND RECEIVER. Arthur J. Mundy, Boston, Mass., assignor to Submarine Signal Company. Filed April 23, 1902. An electric sound transmitter and a refraction sound focuser are arranged in relation to the diaphragm of the transmitter to focus sound vibrations thereon.

921,145. PIPE-CLAMP FOR GROUND-CONTACTS. Theodore Nagel, Chicago, Ill. Filed December 31, 1908. Comprises a band or strap, a saddle having a transverse channel therein, a clamp adapted to bear upon the portions of the strap bridging the channels, and a binding post for securing the clamp to the saddle.

921,176. ELECTRIC-RAILWAY SYSTEM. Ray Stearns, Schenectady, N. Y., assignor to General Electric Company. Filed May 1, 1908. An electric-railway system operating upon alternating current has a supply conductor provided with energized and unenergized sections. There are line switches on the several cars arranged to connect main and auxiliary compensators on the cars to the conductors, and an actuating coil for each of the line switches, which, when energized, causes the switch to close, and when de-energized allows it to open.



920,920.—DETAIL OF COMMUTATOR.

921,183. PROCESS OF REDUCING ORES. Frank J. Tone, Niagara Falls, N. Y. Filed April 11, 1906. A process of reducing compounds of elements which at the temperature of reduction are subject to losses by volatilization, consists in heating a charge of the compound and reducing agent in an electric-arc furnace, keeping the maximum temperature of the charge at a point which will prevent volatilization of this, causing the products to descend from the reaction zone of the arc along an electrically-heated resistance conductor.

921,186. DRY-BATTERY-POSTING MACHINE. Walter G. Waitt, Fremont, Ohio, assignor to National Carbon Company. Filed May 10, 1906. Has saddles secured upon a rotatable table near its outer periphery, associated supports adapted to enter the open ends of battery cells resting in the saddle, and a flexible support, including a contractile coil spring for normally holding a soldering torch so that it may be easily moved to an operative position.

921,187. TELEPHONE-EXCHANGE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company. Filed May 7, 1903. Comprises means whereby the manipulation of a listening key serves to connect a test relay with the tip contact of a calling plug, and a relay serving to provide a secondary control dependent on the insertion of the answering plug within a line jack.

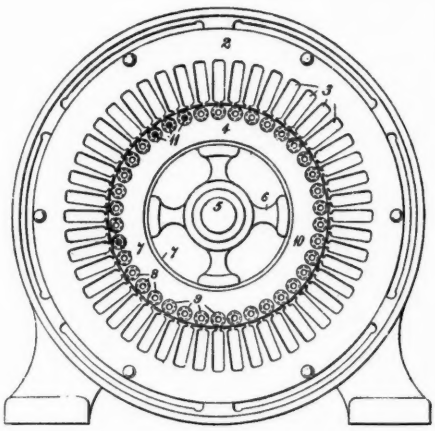
921,196. DETACHABLE PLUG. Puzant R. Yuzuk, New York, N. Y., assignor to General Electric Company. Filed August 17, 1907. Has a base adapted to be secured to a lamp socket, a terminal-bearing portion regularly detachable therefrom, links of fusible metal interposed in the circuit and carried by the base, and a cover secured to the base with openings for the terminals.

921,199. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. David E. Bown, Pittsburg, Pa. Filed March 6, 1906. Has a single solid base of insulating material for the terminals and connecting wires, a flange on this base, and a bent flange on the inner shell for fitting over the base flange to attach the shell to the block.

921,217. OVERHEAD-TROLLEY SWITCH. Edward C. Folsom, Logansport, Ind., assignor of one-third to William M. Simpson, Chicago, Ill., and one-third to James J. Brennan, Fort Wayne, Ind. Filed December 14, 1908. Has a movable member mounted on a baseplate to aline with one rib and either of the other ribs on the under side of the plate, and which form guides for the trolley wheel, and means for swinging the movable member into alinement against the pressure of a spring.

921,228. ELECTRIC FURNACE FOR METALLURGICAL PURPOSES. Paul Girod, Ugine, France. Filed December 20, 1905. Has opposed upper and lower electrodes and a metal-receiving cavity at the end of one of the electrodes, the other electrode being arranged to remain in contact with a slag formed by the fluxes and the fused ore.

921,237. ELECTRIC SWITCH FOR RAILWAY-TRAFFIC-CONTROLLING DEVICES. Lawrence Griffith, Yonkers, N. Y., assignor to Federal Signal Company. Original application filed March 28, 1903. Divided and this application filed June 20, 1904. Comprises a stationary part and two adjacent superposed parts movable relative to each other and relative to the stationary part, each of the three parts being provided with contacts arranged to make or break one or more cir-



920,898.—INDUCTION MOTOR.

cuits upon a partial movement of both of the movable parts in either direction, and means whereby the movement of one of the movable parts will carry the other movable part with it through part of its stroke.

921,265. TROLLEY-HEAD AND TROLLEY. George H. Merwin, Milford, Conn. Filed November 27, 1908. The trolley head comprises a shaft journaled in boxes and having a reduced angular central portion; the trolley has a web with an opening through which the shaft may pass and side plates secured to the web and having radial slots made angular at the inner ends to engage closely the angular portions of the shafts.

921,280. TIME-INDICATING SYSTEM. Albert A. Radtke, Chicago, Ill. Filed June 29, 1908. Renewed January 25, 1909. Is electrically controlled by a master time-indicating device.

921,293. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J. Filed August 30, 1907. Comprises a radiating conductor and inductance included therein, a closed oscillation circuit including this, a spark gap and condensers, and a connection from a source of energy to the terminals of less than the whole number of condensers connected in the oscillation circuit.

921,299. VOLTAGE-REGULATOR. Severn D. Sprong and Walter E. McCoy, New York, N. Y. Filed October 3, 1908. Has a variable resistance controlled by a motor having its field divided into two unequal and oppositely-wound sections, a rotary commutator cylinder with a contact arm, and a solenoid disposed in the circuit and controlled by the voltage thereon.

921,308. THERMOSTAT. John H. Swan, Chicago, Ill. Filed June 15, 1905. Has automatic electrical regulating device.

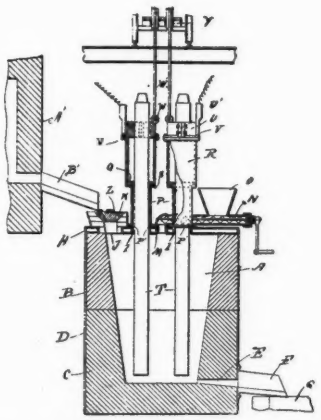
921,311. ALTERNATING-CURRENT REGULATOR. Chester H. Thordarson, Chicago, Ill. Filed July 27, 1906. Has a mag-

netic frame with an upwardly opening recess, a coil supported in this recess, a movable core for the coil supported on the upwardly-facing bearing surface of the frame, and guides on the frame to prevent the core rising from the frame.

921,314. TROLLEY-HARP. Frank A. Tribbe, Ironton, Mo. Filed September 23, 1908. Has an axle detachably engaged at its ends, a sleeve mounted on the axle, springs yieldingly engaged with the sleeve at the ends thereof and engaged with the collars at the ends of the sleeve for holding them in place.

921,318. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed July 5, 1906. Comprises a telephone line extending in two limbs from the substation to the central office and means under the control of the subscriber for energizing a controlling electromagnet to cause the display of a line signal, etc.

921,319 and 921,320. SIGNALING SYSTEMS. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed July 5, 1906. Relays in each of a number of transmitting circuits operate the switching mechanism under certain conditions.



921,325.—ELECTRIC SMELTING FURNACE.

921,321. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed July 5, 1906. A telephone exchange system comprises a testing circuit, a test-responsive device associated with this, a test relay, etc.

921,325. ELECTRIC SMELTING FURNACE. Charles E. Wilson, Hood River, Ore. Filed July 30, 1908. Has a crucible with a truncated obconical opening containing electrodes adapted to slide up and down, a hopper and a screw-conveyor charging device for the mixture, and a water-cooled jacket on top of the crucible. The steel is conveyed to the electric furnace by a chute from an open-hearth furnace.

921,326. SUBMARINE SIGNALING APPARATUS. Edward C. Wood, Somerville, Frederick M. Durkee, Newton, and Walter F. Kelley and Josiah B. Millet, Boston, Mass., assignors to Submarine Signal Company. Filed January 23, 1905. Has an indicating means in circuit with several sets of transmitters in multiple, and means for connecting one set only of the transmitters, or one of these transmitters, at a time with the indicating means.

921,327. BRUSH HOLDER FOR ELECTRICAL MACHINES. John H. Woolliscroft, Hawarden, England. Filed November 20, 1908. Has a member adapted to encircle the brush bar, a toggle device for tightening the member on this bar, brush-supporting means attached to the member and means for applying pressure to the brush.

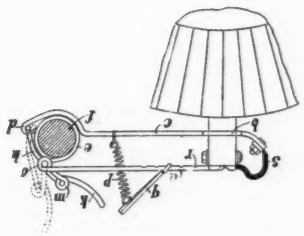
921,334. TELEPHONE TRANSMITTER. Henry F. Albright, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed February 24, 1906. A resistance-varying element has a movable electrode, a cup for enclosing the same, a bridge plate having the central opening therein about which the cup is secured, a diaphragm having a central opening, an interiorly threaded bushing in this opening, a stud projecting from the movable electrode and threaded in the bushing, a front supporting plate, material insulating the several parts from one another, and cord terminals carried by the bridge plate.

921,384. SELF-RESTORING CLEAR-OUT DROP FOR TELEPHONE SWITCHBOARDS. Claude D. Enochs, La Crosse, Wis., assignor to The Vote-Berger Company. Filed April 30, 1906. Includes a head block pivotally supporting a shutter with an in-turned tongue, a keyboard passing through which are a weighted cord and plug, the weight of this plug actuating a lever downwardly, also means for moving this lever upwardly, and a trigger carried by the lever and adapted to engage the tongue to restore the shutter.

921,385. ANNUNCIATOR. Claude D. Enochs, La Crosse, Wis., assignor to The Vote-Berger Company. Filed July 5, 1907. Comprises an electromagnet, a drop shutter associated with it, an armature provided with a latch for the shutter, a removable coil on the magnet provided with a terminal, a connector consisting of a split spring arm pivoted upon a support adjoining the coil and adapted to engage the terminal between its split portions, and means for moving the shutter into engagement with the latch.

921,391. STORAGE-BATTERY PLATE. Bruce Ford, Philadelphia, Pa. Filed July 10, 1907. The grid has open-faced receptacles containing the active material, and laminated retaining walls attached to the plate consist of piles of thin sheets covering the open faces and active material and clamped by the conducting walls of the receptacle with their edges to the active material.

921,392. SYSTEM OF DISTRIBUTION. Budd Frankenfield, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed October 14, 1908. Comprises main conductors, a neutral conductor, a balancer set having armature windings connected



921,327.—BRUSH HOLDER FOR ELECTRICAL MACHINE.

respectively between the neutral conductor and the main conductors, and a booster armature connected in series with one only of the armature windings of the balancer when the system is unbalanced and arranged to generate an electromotive-force in proportion to the unbalancing.

921,398. AUTOMATIC MOTOR STARTER. Clark T. Henderson and Charles H. Miller, Milwaukee, Wis. Filed January 7, 1905. Consists of an electromagnetically operated main switch, a resistance arranged in circuit with the operating winding of this for rendering the winding ineffective to close the switch, and a pressure-actuated switch adapted, when in one position, to close a shunt circuit around the resistance, and when in another position to close a shunt circuit around the operating winding to cause the main switch to open.

921,408. CLUSTER FIXTURE FOR ELECTRIC LAMPS. Paul H. Jaehnig, Newark, N. J. Filed March 15, 1906. Has an inverted frusto-conical body portion of insulating material having a reduced end, a contact ring on the latter, an inner contact ring, and lamp sockets seated on the outer surface of the body portion in contact with the first-named ring.

921,429. MEANS FOR COUNTING CONVERSATIONS AT TELEPHONE EXCHANGES. Johann H. Meyer, Magdeburg, Germany. Filed July 12, 1907. An electromagnetic telephone meter is operated by relays.

921,430. SELF-STARTER FOR ELECTRIC MOTORS. Charles H. Miller, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company. Filed October 24, 1904. A controller has a magnetically operated switch for controlling the circuit through the motor and the winding of the controller.

921,434. KNIFE SWITCH. John H. Miller, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed October 14, 1907. Blades comprising the posts have bowed offsets at the lower ends, in combination with the base having the hole to receive the ends of the blades and form with the offsets a recess adapted to receive securing means.

921,447. APPARATUS FOR AUTOMATICALLY THROWING OUT THE RESISTANCE IN CHARGING STORAGE BATTERIES. George Pattberg, New York, N. Y. Filed October 6, 1908. Has a series of contact members connected to have gradually increasing pressures, a contact device for successively connecting the members with the battery, and means for operating this device to move it successively from one contact member to the other, as the counter-electromotive-force of the battery reaches a degree corresponding thereto.

921,454. APPARATUS FOR THE ELECTRIC LIGHTING OF RAILWAY CARRIAGES. Edwin M. Preston, Deptford, and Alfred E. Kennard, Anerley, England. Filed September 29, 1908. Is a form of electric-light control in conjunction with a dynamo.

921,500. INDICATING AND RECORDING APPARATUS FOR PYROMETERS AND THE LIKE. William Armour, Irvine, Scotland. Filed January 22, 1907. Is an electrically-operated autographic recording device.

921,505. ROTOR CONSTRUCTION. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed June 25, 1906. In a rotary member for dynamo-electric machines, a solid slotted core has integral inclined or taper shaft projections, coils in the slots, wedges or blocks having inclined faces resting on the inclined projections and supporting the coils, and end rings surrounding the end turns.

921,508. THIRD-RAIL SYSTEM. Yorke Burgess, Washington, D. C., assignor to the American Signal Company. Filed January 29, 1908. The conductor stand has a stem rising from a base, roof-supporting flanges formed integral with and projecting laterally from the upper end of the stem, and conductor-supporting lugs projecting laterally from the opposite sides of the stem in position for being overhung by the flanges.

921,512. TROLLEY. Peter Coval and Daniel A. Kunkle, New Kensington, Pa. Filed November 3, 1908. Describes a form of pantograph trolley.

921,526. APPARATUS FOR THE PRODUCTION OF UNDAMPED ELECTRICAL VIBRATIONS. Simon Eisenstein, Kief, Russia. Filed March 27, 1908. Is an oscillator comprising a cathode-ray tube the cathode of which is coated with alkaline oxides, an anode in the tube, and a self-induction coil and capacity arranged in shunt with the cathode and anode.

921,531. RECEIVER FOR ELECTROMAGNETIC WAVES. Reginald A. Fessenden, Washington, D. C. Filed April 25, 1906. A small electrode in contact with an electrolyte is connected to a diaphragm, and arranged so that the pressure of the electrolyte on the electrode is varied by received oscillations and motion is imparted to the diaphragm.

921,584. OUTLET BOX FOR ELECTRIC CONDUITS. William A. Bonnell, New York, N. Y., assignor to Hattie W. Bonnell, Brooklyn, N. Y. Filed August 1, 1908. There are one or more conduit-receiving bushings projecting into the outlet box, and clamping plates arranged on the box and having clamping edges arranged to engage the conduits at the base of the bushings.

921,585. COMBINED CONDUIT CLAMP AND KNOCK-OUT DISK. William A. Bonnell, New York, N. Y., assignor to Hattie W. Bonnell, Brooklyn, N. Y. Filed November 21, 1908. Describes a fitting for electric conduits.

921,589. CONTROLLER FOR ELECTRIC MOTORS. Herbert W. Cheney, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed October 5, 1908. Has a rotatable drum co-operating with fixed contacts, and means whereby the drum in different parts of its movement is biased in opposite directions to off position and is unbiased when in running position.

921,601. INTERRUPTER CIRCUIT AND APPARATUS. John F. Engle, Cleveland, Ohio, assignor to the North Electric Company. Filed June 12, 1907. Has an electromagnetically operated vibratory contact member and two contact parts adapted to be engaged alternatively thereby.

921,625. DOUBLE-CIRCUIT FLASHER. William J. Phelps, Detroit, Mich.; J. Wiley Phelps, administrator of said William J. Phelps, deceased. Filed September 7, 1906. Has a thermostatic switch controlled by resistance heater for one circuit in conjunction with an electrically operated switch for controlling the flow of current through the second circuit.

921,630. SYSTEM OF ELECTRICAL DISTRIBUTION. Barton R. Shover, Chicago, Ill., assignor to Electric Storage Battery Company. Filed December 24, 1906. Uses a transforming apparatus to transfer energy from one to the other of a direct-current circuit and an alternating-current circuit.

921,642. CONTROLLER FOR ELECTRICAL APPARATUS. Frederick Darlington, Great Barrington, Mass., assignor to Westinghouse Electric and Manufacturing Company. Original application filed March 3, 1906. Divided and this application filed October 20, 1908. Has a reversing switch and a clutch between the switch arm and the movable member of the reversing switch that becomes active for any position of the switch arm and remains active only during a predetermined amount of movement of the switch arm in either direction.

921,650. TROLLEY HEAD. John E. Robbins, Greensburg, and William A. Kirkpatrick and Clifford P. Kirkpatrick, Indianapolis, Ind. Filed February 8, 1908. Describes a form of trolley head for electric-car systems.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 18, 1909.

474,847. STANDARD FOR ELECTRIC WIRES. E. C. Morgan, Chicago, Ill.

474,848. ARMATURE FOR ELECTRIC MOTORS. E. C. Morgan, Chicago, Ill.

474,852 and 474,853. SIGNALING APPARATUS. B. J. Noyes, Boston, Mass.

474,854. TRUNK LINE SYSTEM. J. J. O'Connell, Chicago, Ill.

474,857. ELECTRIC-MOTOR MECHANISM. E. B. Phillips, Cleveland, Ohio.

474,907. HOTEL CALL SYSTEM. G. P. Greene, Chicago, Ill.

474,912. ELECTRIC BATTERY. A. S. Keating, Corry, Pa.

474,945. SYSTEM OF SIGNALING. H. A. Chase, Boston, Mass.

474,953. AUTOMATIC POTENTIAL REGULATOR FOR ELECTRIC CURRENTS. A. L. Ellis, Chicago, Ill.

474,977. CUPPING GLASS WITH ELECTRICAL ATTACHMENT. F. Thomas, San Francisco, Cal.

474,980. BURGLAR ALARM. R. G. Vassar, New York, N. Y.

474,984. ELECTRIC LOCOMOTIVE. C. Brown, Naples, Italy, and G. J. Melms, Chicago, Ill.

475,066. ELECTRIC SIGNAL FOR ENGINES. J. C. Ricketson, Milwaukee, Wis.

475,107. ELECTRIC RAILWAY. J. W. Grantland, Philadelphia, Pa.

475,137. ELECTRIC LOCK. F. Morgenthaler, Brooklyn, N. Y.

475,160. ELECTRIC-RAILWAY MOTOR. S. H. Short, Cleveland, Ohio.

475,180. ELECTRIC CONNECTOR FOR CONVERTERS. G. D. Burton, Boston, Mass.

475,181. ELECTRICAL METAL HEATER. G. D. Burton, Boston, Mass.

475,182 and 475,183. METHOD OF ELECTRIC METAL WORKING. G. D. Burton, Boston, Mass.

475,184. ELECTRICAL CONVERTER. G. D. Burton, Boston, Mass.

475,186. ELECTRIC FORGE. G. D. Burton and E. E. Angell, Boston, Mass.

475,187. APPARATUS FOR COOKING BY ELECTRICITY. G. D. Burton and E. E. Angell, Boston, Mass.

475,188. METAL-HEATING APPARATUS. G. D. Burton and E. E. Angell, Boston, Mass.

475,189. ELECTRIC HEATER. G. D. Burton and E. E. Angell, Boston, Mass.

475,190. ELECTRIC COOKING APPARATUS. G. D. Burton and E. E. Angell, Boston, Mass.

475,191. FLEXIBLE ELECTRODE. G. D. Burton and E. E. Angell, Boston, Mass.

475,192. ELECTRIC METAL HEATER. G. D. Burton and E. E. Angell, Boston, Mass.

475,193. ELECTRIC WIRE TWISTER. G. D. Burton and E. E. Angell, Boston, Mass.

475,194. ELECTRIC METAL-BENDING APPARATUS. G. D. Burton and E. E. Angell, Boston, Mass.

475,195. ELECTRICAL FORGE. G. D. Burton and E. E. Angell, Boston, Mass.

475,196. AUTOMATIC ELECTRIC FORGE. G. D. Burton and E. E. Angell, Boston, Mass.